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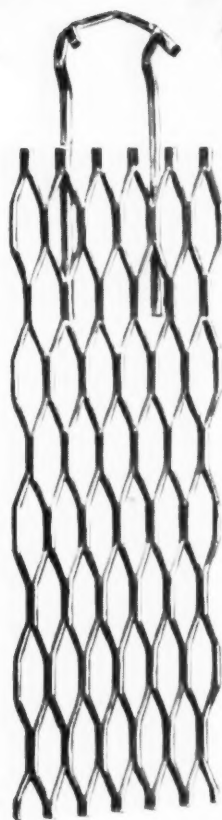
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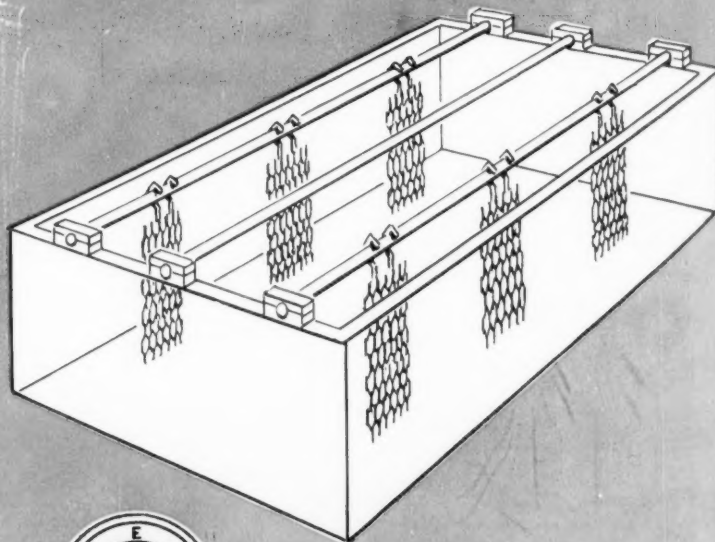
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METAL FINISHING

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COMING SOON

Methods, equipment and solutions used in polishing, buffing and plating 16-inch guns and other Naval ordnance material.

Chromic acid anodizing bath limitations with test results of greater concentrations of sulphate radical.

Importance of water in electroplating baths; equipments used in maintaining minimum impurities in water; test data.

Summary of gold plating methods and equipment used; formulas for baths by immersion and electrodeposition means.



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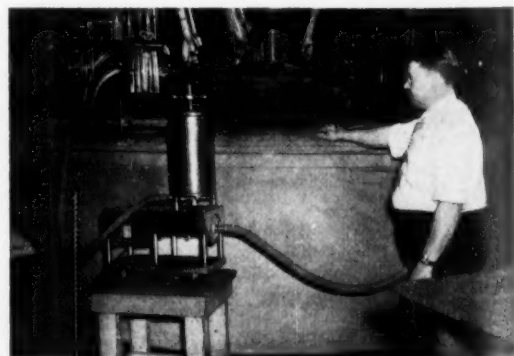
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METAL FINISHING

VOL. 44, NO. 10

OCTOBER, 1946

PREPARATION, ELECTROPLATING, COATING

Adequate Exhaust Facilities

With the accent on health, accident, and comfort conditions in employee-employer relations, it is only the short-sighted individual who will not recognize the importance and economy of adequate exhaust facilities in the finishing departments.

The days of parsimony and of carelessness in providing proper exhaust equipment are over. All too often, modern finishing shops are elaborately set up for the production cycle but have hopelessly dated exhaust systems.

In the polishing room high speed wheels throw lint, abrasive, and metal into exhaust ducts at enormous rates. If improperly designed, the exhaust system will not absorb this waste and the surrounding air becomes completely fouled. As a result, operator efficiency is lowered, the long range health problem becomes serious, frictional fire hazards exist, and a fine film of dust contaminates the work. Many complex problems in subsequent finishing operations can be traced directly to dirt adherence on the work surface.

Plating rooms are no different. Without correct exhaust facilities, toxic fumes become serious health hazards, all sorts of rashes and allergies develop, and various forms of poisoning occur. Untraceable dollars are lost in productive let-down because of fume fatigue. Finished work becomes cloudy or spotted, bright deposits turn dull, and cleaned surfaces show rapid corrosion in fume-laden air. Hard cash must be spent in re-working parts which have been so contaminated.

A dollar placed in adequate exhaust equipment returns many dollars in a better product.

Properties of the Plate

By H. J. SEDUSKY and J. B. MOHLER

Research Chemists, The Cleveland Graphite Bronze Co.

THE steady growth in demand for electroplated materials has been greatly due to a certain "eye-appeal" of the object. Human nature is such that merely covering an article with a thin layer of a precious metal or a bright metal increases its apparent value. Unfortunately for the electroplater, the requirements for an electrodeposit do not end here.

In many applications the plated article must be hard to resist wear, pore-free to resist corrosion, or ductile so that it may be formed into a useful product without cracking during the forming operation. The desired properties obviously depend on the service requirements. However, these properties are not always ideal, for very often one cannot be changed without changing another. If a deposit is hard it will be brittle and if it is brittle it cannot be ductile. There is no more use in striving for a hard, ductile deposit than in attempting to make the deposit hard and soft at the same time. It is possible, however, to have a degree of hardness, and at the same time enough ductility for the part to yield to mechanical forces without failure. To meet such requirements a hardness range may be specified as in bearing applications. Or a limit may be placed on the hardness of a metal, such as chromium, to prevent cracking during grinding operations.

It is natural for a plater to think of chromium as a hard metal and lead as a soft metal. Nevertheless, under proper plating conditions, ductile chromium plate may be produced, and brittle lead may readily be deposited. A soft chromium plate may still be hard as compared to a brittle lead plate because a given hardness can only be used to estimate the ductility of a single metal. For the same ductility in another metal an entirely different degree of hardness is required.

The physical properties of any metal are dependent on its crystalline structure. It is therefore helpful to have an understanding of the basic concepts of crystal structure.

The properties of one metal may only be compared with another when the two metals are in equivalent states. The best basis for such a comparison is a single unstrained crystal

* * *

Wear and corrosion resistance, ductility and crystalline structure are investigated. The effects of heat-treatment on the plated part. Physical properties of electrodeposited materials are covered.

* * *

of metal. Large crystals have been produced by the metallurgist and used as a basis for the study of physical properties. The plater need not be concerned with these large crystals, known as single crystals, nor need he be concerned with crystal structure. Of considerable importance however, is a general knowledge of the effect of crystal size on the properties of a metal.

All metals and alloys, whether electrodeposited or otherwise produced, are made up of a mass of crystals. When the crystals of a pure metal are large the metal is soft, elastic, plastic and ductile. If the crystal size is smaller the metal is stronger, harder and more brittle. This means that if the crystal size is large, the metal will yield to a mechanical force more readily and to a greater extent than for a small crystal size. On the other hand, if the crystal size is small the metal will resist any attempts to distort it to a greater extent and when it does begin to deform it will crack after less movement.

Figure 1 is a diagrammatic plan of the effect of force on metals of large and small crystal size. If a metal of large crystal size is clamped in a vice and struck with a hammer it may be pounded to a right angle without breaking. However, if a piece of the same metal, but of small crystal size, were treated in the same manner it would break. Considerably more force would be required in this case than the force required to deform the metal in Case A.

The simple concept of crystal size for a pure metal then is: a single unstrained crystal is soft, while a number of small crystals cause a metal to become hard and to take on the properties associated with hardness.

Crystallinity

The mass of crystals that make up a metal may be large enough to be readily seen with the naked eye, or may be so small that they cannot be resolved under the microscope.

Much experimental effort has been expended to develop plating baths that will produce bright, smooth, finely crystalline deposits. The crystal size from alkaline solutions, cyanide solutions, and acid solutions containing addition agents, is generally small. When these plating baths are out of control they may produce large crystals that appear as a crystalline plate, as crystal trees, or even as a powder of loosely adherent crystals.

Smooth plates of large crystal size may be deposited from a simple acid bath such as the copper sulfate bath providing limiting conditions (such as foreign solids in the bath) are

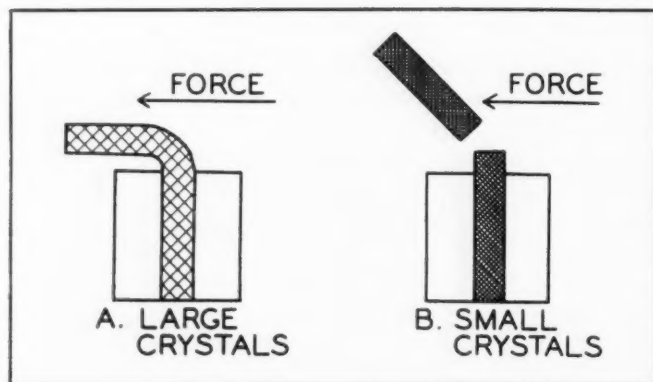


Fig. 1. The effect of force on crystal size.

carefully avoided. The tendency toward formation of trees and large crystal size deposits can be appreciably reduced by the addition of glue to the bath.

When the crystal size is small the deposits tend to be smooth and in some cases bright. The brightness, however, may in some cases be due to the manner in which the crystals grow rather than due to the crystal size.¹

If the crystal size is small (so that the deposit resists mechanical force) the deposit will possess greater hardness; it will probably have a greater resistance to wear; it may be more difficult to buff; more brittle, and hence less ductile.

The properties desired in the deposit depend on the application. For instance, chromium may be deposited bright for decorative purposes, or it may be deposited hard to resist wear. If it is used to build up a worn part where hardness and wear are not important, it may be deposited soft for machinability.

Figure 2 shows how the hardness of a chromium deposit may be changed by changing the temperature of the bath. While the exact role played by crystal size in this example is not known, it is known that all chromium deposits are of an extremely fine crystal size. The difficulty of measuring very small crystals and the introduction of secondary factors such as inclusion of foreign material in the plate, prevent the prediction of physical properties based on crystal size alone.

In applications where the physical properties of the plate are specified and controlled, the effect of crystal size should be kept in mind, since change in crystal size means change in physical properties.

Stress

If a metal is deposited on one side of a thin foil, the foil may bend during deposition.³ This distortion is a measure of the forces trapped within the deposit and is a measure of internal stress. The foil may bend toward the anode or away from it depending on whether the deposit contracts or expands as it grows. If the stressed metal is deposited over a rigid cathode then more stress is present in the metal than if the cathode is flexible, for if the cathode can bend part of the stress will be relieved by the force required for the bending.

In cases of severe internal stress the forces may be of a great enough magnitude to tear the deposit from the basis metal. Peeling will result.

Internal stress is often indirectly controlled through such variables as current density and temperature.⁴ These factors are known to cause a variation of internal stress. By proper control, internal stress in the form of cracked and brittle deposits may be avoided. High internal plating stress results in greater hardness just as hardness is increased in steel through trapped stresses induced by cold working.

Crystal Growth

The size and distribution of crystals in a deposit depend on the number of crystals growing during deposition and the rate of formation of new crystals. The point at which a new crystal starts to grow is a nucleus produced by a change in surrounding conditions that favor the beginning of crystal formation.

If an electric current is passed through an aqueous solution of a salt containing a metal more noble than hydrogen,

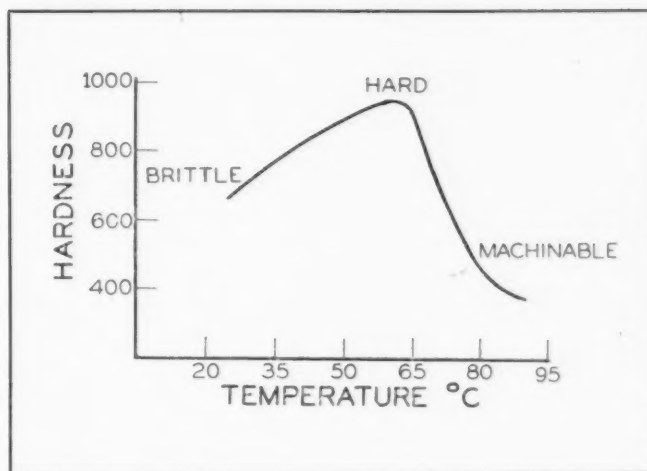


Fig. 2. Hardness of chromium deposits.

then reduction of the metal ion must take place at the cathode. The reduction of the ion to the metallic state occurs in the form of crystals deposited at the cathode. But the size, shape, and number of crystals depends on the environment. Similarly, if a saturated aqueous solution of a salt (that is less soluble at lower temperatures) is cooled, then crystals must form. But the size, shape and number of crystals formed depend on the environment. If the solution is cooled slowly, starting points of very tiny crystals, or nuclei, will be formed at relatively few points. Further growth will take place on these nuclei, and on continued slow cooling no new starting points will be formed and large crystals will result. If on the other hand, cooling is rapid, many nuclei will form and new nuclei will continue to form during the rapid cooling period. A greater number of crystals will form than in the case of the slow cooling, and the crystals will therefore be comparatively small.

When crystals form from a melt, whether it be a molten metal or a molten salt, sudden chilling of the containing vessel will result in small crystals forming next to the cold surface. As freezing proceeds and the rate of cooling decreases, large crystals will form on top of the smaller ones. The small crystals have a random distribution, whereas the large crystals have a directional growth toward the center of the container. Figure 3 is a diagrammatic sketch of the type of crystals obtained by chilling a containing vessel or by casting into a cold mold.

In Figure 3 the small random crystals are formed during a period that favors the formation of new nuclei while the large crystals grow during a period that does not favor nuclei formation.

Crystals formed during electrodeposition are much smaller than crystals formed by these other methods. As an example; a crystal of table salt that would be considered small could still be readily seen with the naked eye, yet an electrodeposit showing crystals of such size would be regarded as a deposit made up of large crystals. Conditions during electrodeposition may be such that favor the formation of either microscopic crystals or crystals sufficiently large to result in a definitely crystalline plate.

The condition of the basis metal sometimes has a pronounced effect on the crystals that subsequently form.⁵ If acid copper is deposited on etched, cast copper, it tends to repeat the crystal structure of the underlying metal; but if

it is deposited on buffed copper, then the structure is likely to be a miniature of the behavior of crystals first formed from a melt. In the former case the clean, etched copper exposes a familiar crystal formation for crystallization to proceed; whereas in the latter case the worked surface favors the formation of new nuclei. In some deposits (such as heavy cyanide silver deposits) the crystal pattern follows one similar to that in the formation of a solid from a melt. The first crystals formed are small and random; these are followed by larger, long, directional crystals. However, by the use of certain sulfur containing addition agents, a continuous deposition of small random crystals is produced and the deposit will be smooth and bright. The exact mechanism by which the addition agent functions is doubtful but the result and the effect on crystal size can readily be observed.

The presence of foreign materials in plating baths modifies crystal growth in many ways as illustrated by the experimental study of the effect of addition agents on a plating bath.⁶ Plates are formed in so many different ways that it is difficult to find enough adjectives to describe their appearance. The plates may be treed, nodular, crystalline, burned, leafed, etc. A good addition agent is usually one that favors the formation of new nuclei, resulting in deposits of small crystal size and as a consequence produces smooth or bright plates which do not tree or burn in high current density areas. Certain organic materials and in many cases colloidal materials such as glue, reduce the tendency to form larger crystals. In alkaline or cyanide baths, the tendency of the bath to form basic salts at the cathode may produce the same effect so that no addition agent is required. The presence of these materials in the plate is extremely small, often of the order of 0.001 percent, but on careful chemical analysis they may be detected.

Certain metallic impurities in a bath may result in treed, rough or spongy deposits due to interference of crystal growth so that a desirable plate structure is not obtained.

Figure 4 shows a crystal that normally forms a cube. If a substance is present that interferes with growth in direction B and C or promotes growth in direction A a needle will be formed.

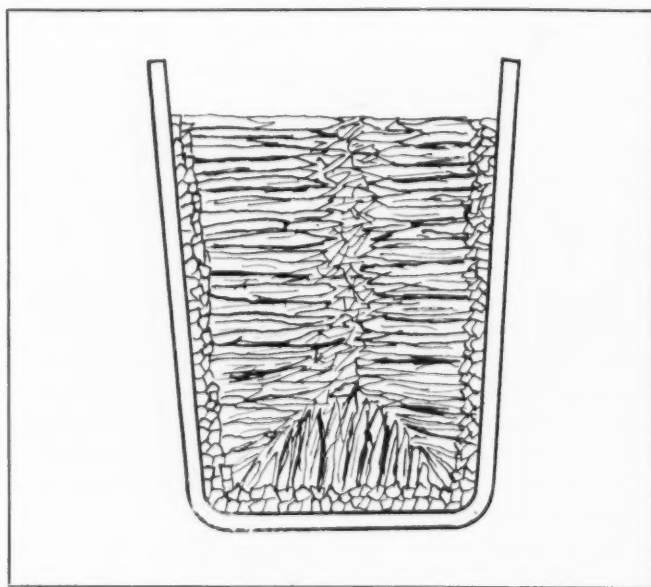


Fig. 3. Crystallization.

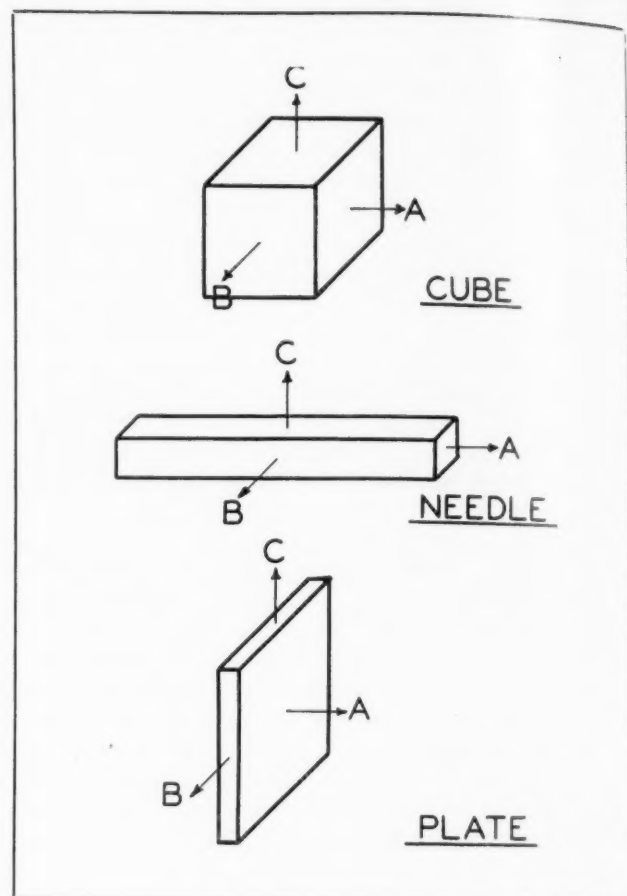


Fig. 4. Crystal growth.

If growth is inhibited in direction A a plate will be formed.

Through interference of growth in a given direction or in several directions, foreign substances bring about the many unusual plates sometimes encountered.

Heat Treatment

Changes in structure, crystal size and physical properties of an electrodeposit may be brought about by heating. This heating is known as heat treatment, or annealing, and the primary change taking place is known as recrystallization.

In introducing the term "recrystallization" we would like to pause to introduce the term "grain."

We have been talking about crystal size for some time and we mean the same thing that the metallurgist means when he talks about grain size. As defined in the Metals Handbook grains are "Individual crystals in metals."

"Recrystallization" is the term used to denote changes in which small grains may become larger at the expense of neighboring grains (by diffusion of atoms across grain boundaries). If impurities are present within the grains, they may migrate toward the grain boundaries during recrystallization and inhibit further diffusion and grain growth.

If a deposit is under internal stress, the stress will be relieved during grain growth brought about by recrystallization. Grain growth and stress relief will take place at a minimum temperature for each specific metal. In the case of lead deposits, stress relief will take place at room temperature and such a deposit is therefore "self-annealing."

(Continued on page 428)

Engineering an Anodizing Installation

By ROBERT S. HERWIG

Chief Plating Engineer, Bogue Electric Co., Paterson, N. J.

IN ORDER to take advantage of the plentiful supply of aluminum and the resultant increase in aluminum products, many platers are investigating the costs and the equipment needed for a complete anodizing installation.

To begin with, the plater has the choice of many baths, the chromic acid bath of Bengough and Stuart and the patented sulphuric acid bath of Alcoa being the most common. Both baths will produce an oxide coating on aluminum alloys. However, in general, harder and deeper oxide coatings are obtained in the sulphuric acid baths on all types of aluminum alloys while the chromic acid bath cannot be used on aluminum alloys containing 5% or more of copper. On the other hand, if the aluminum product contains welding or is of such intricacy that residual acid is left after rinsing, then the chromic acid bath should be used. Except for a possible stain left from entrapped chromic acid there will be no corrosion on the aluminum. However, since it is not the purpose of this paper to discuss the merits of the two baths, I will limit the discussion to the installation of the sulphuric acid bath.

Having prepared below a list of the basic equipment needed for a manual operated anodizing installation, we can then go into detail for each item.

1. Source of D. C. Supply
2. Cleaning Bath
3. Rinse Tanks
4. Anodizing Tank
5. Dye Baths
6. Sealing Bath
7. Aluminum Racks and Wire

Source of DC Supply

Depending on the concentration of the electrolyte and the type of aluminum alloy the voltage will vary from approximately 15-24 volts. There are two convenient sources of supply, namely, rectifier and motor generator set. Both types are used extensively and both have their merits. In general, motor generator sets deliver a purer D.C. voltage with greater prolonged overload capacity while rectifiers have the inherent characteristic of delivering a comparatively high ripple voltage. Since the mechanism of anodizing is such that the aluminum is attacked by the sulphuric acid and then immediately converted to an oxide by the nascent oxygen liberated at the anode, it is important that the DC voltage be constant with any change in load. This condition becomes more important on highly polished aluminum where slight fluctuations of voltage adversely affect the finish.

In a well designed motor generator set, voltage regulation which is defined as the difference between no-load voltage and full-load voltage divided by full-load voltage expressed in percent, is approximately three percent. In the metallic type three phase rectifiers the voltage regulation will be ap-

proximately twenty-five percent. This voltage regulation can be further reduced by the use of an automatic regulator.

As far as the price of group rectifiers and motor generator sets of comparable sizes in 24 volts supply, the first cost of a motor generator set may be somewhat less. To offset this difference in price, rectifiers have the advantage of being more flexible, have somewhat lower maintenance cost and introduce a savings in power cost through higher efficiency at partial loads and the eliminating of tank rheostat losses. If the MG set is used for anodizing solely, the same economy of power will be realized when operating at bus voltage.

Cleaning Bath

In general very little cleaning is needed for preparing the aluminum product for anodizing. Usually hand wiping with gasoline or carbon tetrachloride or the use of a vapor degreaser is sufficient. However, if a refrigerated anodizing bath is to be used to provide a protective coating for a highly polished aluminum product, a more uniform appearing coating will be had if the aluminum is first cleaned in an inhibitive aluminum cleaner to remove last traces of the polishing rouge. It is quite essential that the rinsing after alkaline cleaning be very thorough as drag in of alkali will not only neutralize the sulphuric acid bath but will tend to precipitate sticky fatty oils in the bath and on the work. This condition is especially serious if the rinse water is hard or if the anodizing is to be conveyorized and the time for rinsing is quite short. This situation can be easily remedied by installing a water softener in the main water supply which will then deliver water of zero hardness. Since most aluminum cleaner baths are operated at 160-180° F, a means for heating the cleaner must be had. The tank for holding the alkaline cleaner may be constructed of mild carbon steel and should be constructed with a dam type overflow along one side of the longest length. Then if the heating supply is placed at the opposite side, the convection current caused by the heat will cause the topmost surface of the solution to drift toward the overflow dam, thus making it a simple matter to skim off the excess oil and grease.

The capacity of the heating device, whether it be gas fired at the bottom, black iron steam coil inserted in the solution or an immersion heater, should be such that the temperature can be raised from 62° F to 212° F in two hours.

Rinse Tanks

A typical anodizing installation will require two rinses, one for rinsing the work after alkaline cleaning and one for rinsing the work after anodizing. It is not good practice to try and combine the rinses into one tank as the residual alkali left in the rinse tank from the alkaline cleaning may react with the acid left on the aluminum product to form a sticky substance which is difficult to rinse off. This is

especially true if the aluminum cleaner contains appreciable silicates.

The material for the alkaline rinse tank may be wood or steel. Many platers do not line the cold water rinse tank since the drag in of alkali does offer some protection to the steel both by raising the pH of the water and depositing a scum on the sides of the tank which is reminiscent to the ring around the bathtub. The rinse tank after anodizing should be given a protective coating. There are some excellent products on the market that can be applied as low as a \$1.00 per square foot which not only gives protection to the steel from rusting but are also acid resistant coatings.

Anodizing Tank

The anodizing tank for containing the sulphuric acid is preferably lined with 10-12 lb. chemical lead costing approximately \$2.00 per sq. foot lined. In this way, the lead lining can act as the other electrode. It is still quite a controversial subject as to how the anodizing tank should be constructed. For example, the operating temperatures for anodizing can vary from 60° F to 90° F depending on the type of work and the final finish required. The harder and less porous coatings are obtained at the lower temperatures while the deeper and more porous coatings are obtained at the elevated temperatures. The coatings for dyeing purposes are usually obtained at the intermediate temperatures and for special purposes can be obtained as low as 70° F.¹ This then presents the question as to whether a heating unit should be provided. Many platers take the stand that since practically all of the electrical energy input is converted to heat, one or two runs of work in a cold tank will raise the temperature to the desired operating temperature. For example, let us assume that with a full tank containing 850 gallons of solution we are drawing 1400 amperes, since for experimental purposes 100% of the electrical input is converted into heat, then:

$$\text{Current} \times \text{Voltage} = \text{Watts}$$

$$1400 \times 24 = 33,600 \text{ Watts or } 3.36 \text{ KW}$$

$$1 \text{ KW} = 56.88 \text{ BTU/min.}$$

$$3.36 \text{ KW} \times 56.88 = 1910 \text{ BTU/min. of Anodizing}$$

Since 1 BTU will raise the temperature of 1 lb. of water 1° F and we have approximately 7,000 lbs. of solution, then:

$$1910 \text{ BTU/min.} \times 30 \text{ min.} = 57,300 \text{ BTU}$$

$$\frac{57,300}{7,000}$$

$$= 8.4^\circ \text{ F rise in 30 min. of anodizing}$$

If the temperature of bath were 60° F, it would take one hour of anodizing to raise the temperature to 76.8° F.

If only dye work is being done in the shop it will be necessary to install a heating unit as the aluminum parts anodized at 60-70° F will not dye uniformly or give the depth of color as those obtained at the higher temperature.

In our preceding example, the temperature of the electrolyte raised 8.4° F in 30 min. It is obvious then that some means of keeping the temperature constant is necessary. And since the problem is not one of heating but one of cooling, refrigeration must be used. There are 3 convenient methods of cooling the solution. One method is by passing refrigerated water through lead coils placed in the tank. Another method is to pass the refrigerated water through a jacket surrounding the anodizing tank and the third, which is the

most efficient, is with an outside heat exchanger. With an outside heat exchanger the velocity of the solution to be cooled can be increased thereby using smaller cooling surface, obstructions are removed from the tank and the size of refrigeration unit can be reduced to a minimum because of the decrease in surface exposure of the cooling medium. Another advantage of the outside heat exchanger is the excellent agitation given the solution by the constant recirculation.

Since we are going to use the sides of the tank as the cathode, it is essential that some means be taken to prevent shorting of racks and parts while loading and unloading, and shorting from parts dropping from racks and touching the bottom of tank. This is most important if bulky work is to be treated or if, at a later date, the installation is to be conveyORIZED. Numerous materials can be used but one which is inexpensive and gives excellent results is cypress wood grating on the bottom and wooden sheets on the side which holds the bottom grating in place.

The fumes from the anodizing tank must be exhausted as considerable spray of sulphuric acid is liberated at the work along with impure hydrogen and oxygen gasses. The exhaust duct is preferably made of lead and can be installed along the far side so as to give no obstruction over the tank. The exhaust fan should be asphalt lined and be of sufficient capacity to create a draft of 5 feet per second over the work rods.

The controls for the anodizing tank should consist preferably of a recording voltmeter and ammeter, a manual or automatic master control switch and a voltage regulator permitting control within range of 12-24 volts.

If an outside heat exchanger is not used means of agitating the electrolyte should be provided. Air agitation is entirely satisfactory.

Dye Baths

Since the dye baths are usually operated on the acid side it is advisable to line a carbon steel tank with monel or stainless steel. The heating unit should be also of monel or stainless steel. The tank should be provided with means of agitating the solution and air agitation again is satisfactory. The concentrations and the pH of the various dyes vary for each shade and the best conditions for each color can be had from the dye manufacturers.

Sealing Baths

There are three types of sealing baths commonly used:

1. Hot Water
2. 5% Potassium Dichromate
3. Nickel Acetate

When using the hot water seal, it is essential that the water contain a minimum of iron, copper or manganese. Since the mechanism of sealing in water consists of converting the aluminum oxide to an aluminum hydrate it will occlude all impurities in the water. In the case of highly polished surfaces, they will be dulled by these impurities and even streaked. It is advisable if fairly pure water is not available to install a water softener. The same water softener which was used to obtain soft water for the rinses can be used to remove copper, iron and manganese by basic ion exchange.

The tank used for the sealing bath must be lined with a corrosion resistant lining. The water should be kept at 190°

¹ Herwig, Monthly Review, June 1946.

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200° F with a pH of 6.0-6.4 and the time of immersion may vary from 5 minutes to 15 minutes.

The 5% sodium dichromate is used solely to increase the corrosion resistance of the anodized aluminum. Since this bath imparts a yellow color to the aluminum it is seldom if ever used with decorative finishes. This bath is operated at the boiling point and the pH is maintained 5.0-5.5.

The nickel acetate bath is prepared as follows:

Nickel acetate (5 gm/liter)

Acetic acid to adjust pH to 5.0

Temperature 200° F to boiling.

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The mechanism of this bath is to precipitate nickel hydroxide in the pores. The water fastness is further improved after setting by immersing in boiling water for 15-30 minutes. Bleeding of the dye may occur at first but at the end of about 30 minutes there is seldom any further loss of color.

Aluminum Racks and Wire

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The use of correctly designed racks and the selection of the right alloy wire is of the utmost importance in anodizing. In regular plating operations copper wire is used exclusively and the operator need only be sure that the wire is thick enough to carry the current required. In anodizing, the operator should know the exact aluminum alloy he is working with and the aluminum alloy of the wire. This is necessary since all aluminum alloys do not anodize at the same voltage. Since they all require different voltages to obtain the same current densities it becomes apparent that if alloys are mixed, the alloy requiring the lower voltage will act as a thief and pass most of the current. Therefore the aluminum for the wire or rack must be selected so that the wire or rack requires as high or higher voltage to anodize. In this way the required thickness of anodic film will be obtained on the work. The use of stop-off lacquers will minimize much of this trouble.

Very little anodizing is done in barrels as bulk parts can be handled in specially designed aluminum containers. Alu-

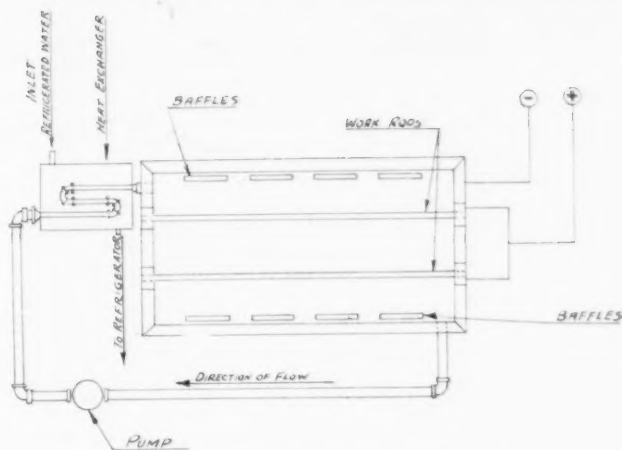


Figure 1. Sketch of outside heat exchanger.

minum wire made into coils is often used to hold small parts which are to be dyed. Springs and clamps of aluminum are also frequently used.

Conclusion

It can be readily seen that very little new equipment will be needed for the average plating shop to take advantage of the plentiful supply of aluminum and to add the anodizing and dyeing of aluminum parts to its list of baths.

It is recommended that prospective installers of anodizing equipment first consult the patentee² for a license and then engage a reputable electroplating equipment supplier who can furnish the necessary equipment and supply the know how gained from years of experience. It must be remembered that anodizing and dyeing of aluminum parts is somewhat of an art and it is not recommended that the average plating concern swing over to anodizing without obtaining some expert advice.

² Aluminum Company of America.

Architect's model of the Federal Telephone and Radio Corporation laboratories at Nutley, New Jersey, as they will appear when construction is completed.



Colorimetric Determination of Molybdenum in Zinc Cyanide Plating Solutions

By Louis Silverman, Virginia Stewart and Jane Davies

THE two analytical methods most used for the determination of molybdenum in zinc cyanide plating solutions are (1) permanganate titration after reduction by amalgamated zinc and (2) colorimetric estimation after extraction of the pentavalent thiocyanate $\text{MoO}(\text{CNS})_3$. The first method is rather lengthy, since iron must first be separated as hydroxide. One precipitation is insufficient to remove molybdenum. On the other hand, extractions are not too rapid.

In this paper it is proposed to show that molybdenum can be determined colorimetrically in aqueous solution and that concentrations of molybdenum as high as three milligrams per hundred milliliters of aqueous solution are feasible. Iron and organic wetting agents do not interfere.

Experimental Results

The standard reference solution was prepared by dissolving 1.89 gm. of sodium molybdate ($\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$) in water and diluting to one liter. Ten milliliter aliquots were withdrawn, and the molybdenum content determined (1) by the Jones Reduction—Permanganate method^{1,2} and by the gravimetric lead molybdate method (most accurate method)¹. The molybdenum content was calculated in terms of "ounces per gallon." The reference solution was found to contain 0.098 oz./gal. for each milliliter aliquot.

To prepare calibration curves, accurate aliquots of the standard solution were placed in 150 ml. beakers. 50 ml. of water were added, then 5 ml. of 1:1 sulfuric acid, 10 ml. of 10% ammonium thiocyanate and 10 ml. of stannous chloride solution in order. The solutions were stirred after

the addition of each reagent. Each solution was poured into a 100 ml. volumetric flask, diluted to the mark with water, immediately mixed, returned to the original beaker and stirred well. The color was allowed to develop over a period of five minutes. Visual examination showed that the lower color concentrations could easily be distinguished, but that a colorimeter would be required for the higher color concentrations. The color range is from straw color to very deep red.

An Evelyn Colorimeter was used for this investigation. Several color filters were found useful. Those filters below 500 μ did not permit sufficient transmission, but those be-

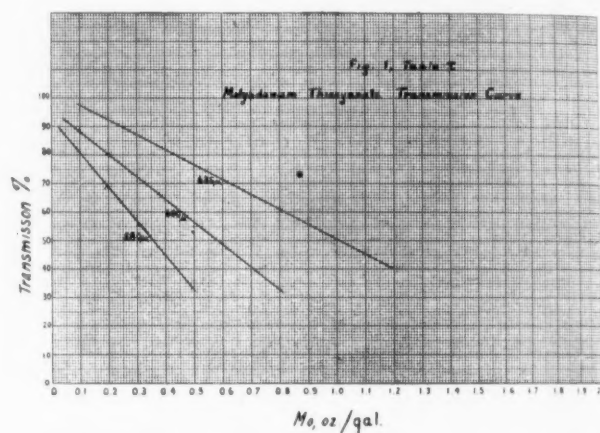


TABLE I
Molybdenum Transmission Curve(a)

Age:	Mo oz./ gal.	10 Minutes				180 Minutes			
		580 μ	600 μ	635 μ	565 μ	580 μ	660 μ	635 μ	
1.0	0.1	82.5	89	96	72	84.5	92	96	
2.0	0.2	69	80.5	93	48.5	70	83	92	
3.0	0.3	55.5	71	88	32	56.5	73	88	
4.0	0.4	45	64	87	30	55	71.5	89	
5.0	0.5	35.5	55	77.5	15	39.5	57.5	78.5	
6.0	0.6	29.5	49.5	73	11.5	34.5	51	72.5	
7.0	0.7	19.5	38.5	65.5	8	29.5	48.5	72	
8.0	0.8	15	34	59	5	22.5	39	61.5	
9.0	0.9	12	30	58	2.5	18	34	60.5	
10.0	1.0	9	22	46					
11.0	1.1	8.5	21	46					
12.0	1.2	9	19	41					
15.0	1.5	4	14	35					
20.0	2.0	2	8.5	26					

(a) Reagents: 5 ml. 1:1 H_2SO_4 , 10 ml. NH_4CNS , 10 ml. SnCl_2 .

tween 500 μ and 600 μ were found to have specific desirable properties. Transmission data are given in Tables I, II and III. Corresponding curves are plotted in Figs. 1 and 2.

To determine stability and permanency of color of the solutions, the beakers were stored in an ice chest for one or more hours. The transmission curves were then determined as before. The results are tabulated in the Tables. To confirm reproducibility two months later another analyst prepared a series of beakers and obtained transmission data. The results are tabulated in Table II, Fig. 2.

Procedure

Size of Sample. If the expected molybdenum content is between 0.3 to 0.7 oz./gal., pipette one milliliter into a 150 ml. beaker; if the content is less than 0.3 oz./gal., pipette two milliliters into a 150 ml. beaker. Concentrations greater than 0.7 oz./gal. are not used.

Treatment of the Sample. To the 1 ml. or 2 ml. sample, add 5 ml. of nitric acid and 3 ml. of perchloric acid (70%). Add one drop of hydrofluoric acid (48%) to each sample. Cover. Heat until most of the solution has evaporated and solids appear. Remove from the heat. If the solution does not solidify within 10 seconds, heat until it does. After cooling, add about 50 ml. of warm water and 5 ml. of 1:1

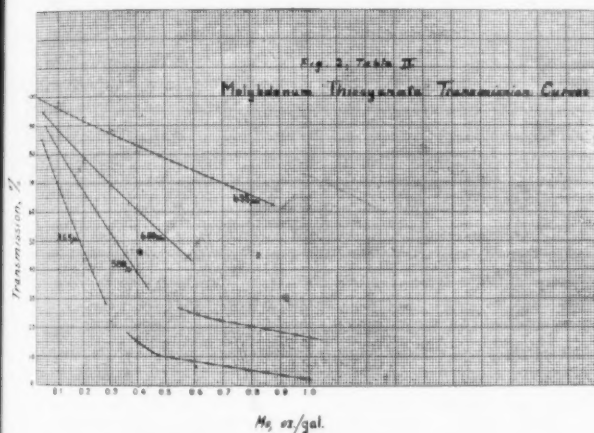
sulfuric acid. Dissolve the solids. Heat to boiling, and boil several minutes. Cool in running water to about 15° C.

Color Development. Add 10 ml. of 20% ammonium thiocyanate. Stir. Add 10 ml. of stannous chloride reagent. Stir. Pour the solution into a 100 ml. volumetric flask and rinse the beaker with cold distilled water into the flask. Dilute to the mark. Mix well. Pour a sufficient amount of liquid into the colorimeter tube. Let stand at least five minutes.

Determine the transmission or absorption of the solution in a photometric apparatus, or compare color densities visually with standards.

Standards are prepared as follows: Place 50 ml. of cold distilled water in each of a series of 150 ml. beakers. Pipette in specific volumes of a calibrated solution of sodium molybdate. Develop the color with sulfuric acid, thiocyanate and stannous chloride exactly as in the procedure above. Dilute to 100 ml. in volumetric flasks. Use these solutions for standardization curves for the photometric instrument, or for visual comparisons.

Synthetic standards should be prepared for each new set of determinations whether the procedure is the visual or the photometric one.



The H_2SO_4 , NH_4CNS and $SnCl_2$ may be added from burettes or Mohr pipettes. The volumes of these reagents stated in the procedure seem to be the most desirable.

Discussion

The sample is digested with nitric-perchloric acids rather than with nitric-sulfuric acids since sodium bisulfate usually retains nitric acid. Nitric acid accelerates fading of the molybdenum color.

Samples which contain considerable sodium salts will bump when heated strongly with perchloric acid. This will not occur if the size of sample is limited to two milliliters.

The acidity is of major importance, especially for the higher molybdenum concentrations. The first step in control is the evaporation of the nitric-perchloric solution to near dryness. In this way all organic matter and nitric acid will be destroyed, and the residual perchloric acid is a minimum. After adding water a measured portion of acid is added. The effects of five milliliters of 1:1 sulfuric acid and of one milliliter of hydrochloric acid were tried. The latter develops a somewhat redder color. To study this, increased portions of thiocyanate and sulfuric acid were added to

TABLE II

Reproducibility: Molybdenum Transmission Curve(a)

Age: Mo oz./ gal.	30 Minutes							
	565 μ	% Transmission		580 μ	600 μ	635 μ		
0.1	69(b)	70(c)	82(b)	82(c)	89(b)	88(c)	98(b)	97(c)
0.2	44	43	65	66	79	78	92	93
0.3	27	27	53	53	70	69	88	89
0.4	17	15	42	39	60	58	83	81
0.6	7	9	26	32	46	52	73	78
1.0	2	2	17	17	36	36	61	65

(a) Reagents: 5 ml. 1:1 H_2SO_4 , 10 ml. NH_4CNS , 10 ml. $SnCl_2$.

(b) and (c) are different solutions.

standard molybdenum solutions. Such solutions developed colors, but faded more so, within two hours, than those containing only five milliliters of 1:1 sulfuric acid and ten milliliters of thiocyanate. Also, in line with acidity control, the thiocyanate (which has buffer properties) and the stannous chloride (which contains hydrochloric acid) are added by means of Mohr pipettes (± 0.1 ml.). Finally, the test solution is diluted to 100 ml. in a volumetric flask.

Of the possible interfering metals, iron is converted into ferric perchlorate and reduced to colorless ferrous ion; copper is converted to insoluble, white, cuprous thiocyanate, which, if present in appreciable amounts, must be settled out, centrifuged or filtered off; silver, rarely present, should easily settle out as thiocyanate; nickel color may be corrected for by determining the transmission (greater than 100%) of a duplicate solution containing no thiocyanate, or by previous separation as nickelic hydroxide by the cyanide-bromine method; lead is not present in sufficient concentration to interfere; chromium color may be corrected for by a transmission blank; and zinc and sodium, always present, do not interfere.

The advantages of the use of the photometric apparatus have frequently been described. It is apparent from the curves that at low concentrations the 565 μ filter is appropriate, but that at higher concentrations the 635 μ filter is required.

Curves must be prepared for each instrument since the color filters of different instruments are not likely to be identical. The graphs for each instrument however, must be reproducible.

The optimum time for the color determination is five to thirty minutes after the color has developed. The higher molybdenum color concentrations are not stable over longer periods of time.

Sample Calculations

Visual Estimation:

(1) High Mo Content. Prepare standards ranging from 0.2 to 0.8 oz./gal. by using aliquots of 2, 3, 4, 5, 6, 7, 8 ml. of reference standard solution. Assume that the value of the standard is 1 ml. = 0.0982 oz./gal. Also prepare the test solution according to the procedure.

Suppose the color of the test solution lies between the 3 and the 4 ml. standards, and is closer to 3 ml. than to 4 ml. Call it 3.3; then 3.3×0.0982 oz./gal. = 0.32 oz./gal. of Mo.

(2) Low Mo Content. Prepare standards ranging from

TABLE III
Molybdenum Transmission Curve(a)

Age:	15 Minutes				200 Minutes			
Mo	% Transmission				% Transmission			
oz./gal.	565 μ	580 μ	660 μ	635 μ	565 μ	580 μ	600 μ	635 μ
0.1	70	83.5	89	97	90	97	100	101
0.2	46	68	80	94	68	85	90	99
0.3	29	54.5	70.5	89.5	52	75	85	97
0.4	18	43	62.5	85.5	41	65	74	95
0.5	12	35.5	56	82	33	59	73	93
0.6	6.5	26	47.5	78	30	56	71	92
0.7	5	23	43.5	76.5	13	37	53	84
0.8	3	18.5	38.5	72	9	30	52	83
0.9	1.5	14	31.5	65.5	6	24	47	75
1.0	1.0	11.5	28.5	62	5	23	45	75

(a) Reagents: 10 ml. 1:1 H_2SO_4 , 15 NH_4CNS , 10 ml. $SnCl_2$.

0.25 ml. up to expected range. Prepare test solutions using 2 ml. samples according to the procedure.

Suppose the color of the test solution lies between the 4 ml. and 5 ml. standards, and seems to be just half-between the two in color intensity, then $\frac{1}{2} \times 4.5 \times 0.0982$ oz./gal. = 0.22 oz./gal. of Mo.

Suppose the color of the test solution lies between the 0.25 and 0.50 ml. standards, but closer to the 0.50 standard, then $\frac{1}{2} \times 0.40 \times 0.0982 = 0.02$ oz./gal. of Mo.

The " $\frac{1}{2}$ " multiplier is used since a 2 ml. test solution was taken.

Photometric Estimation:

Prepare a series of standard solutions containing from 0.25 to 1.0 ml. of reference standard.

(1) High Mo Content. Use a filter such as 635 μ . Plot the curve, Transmission vs. Mo Content.

Suppose the test solution (1 ml.) has a transmission of

PROPERTIES OF THE PLATE

(Continued from page 422)

but at higher temperatures the crystallographic changes will take place in a shorter period of time. In metals characterized by a high melting point, "self-annealing" effects will not take place so that if recrystallization is desirable it is necessary to use heat; the extent of the change depending on the temperature and to a lesser extent on the time of heating.

Heat treatment is desirable when a soft and ductile deposit is required. This result may be brought about by increasing the grain size through recrystallization; thus decreasing brittleness and hardness so that a plated part may be more easily buffed, machined or formed.

Heat treatment is often resorted to in order to relieve a type of brittleness known as hydrogen embrittlement. This brittleness is common in a chromium deposit and is brought about by absorption of active hydrogen given off at the cathode during plating. By heating the deposit, the hydrogen may be driven out to relieve this brittleness which often causes trouble in a grinding operation. Usually in an engineering application it is desirable that the chromium be hard but not brittle. Therefore the chromium must be heated (to the proper temperature and for the proper time) to

64%. Read across to the curve, down to the abscissa and find the Mo Content in oz./gal. If a 2 ml. test sample was used, the abscissa reading must be divided by two.

(2) Low Mo Content. Use a filter such as 565 μ . Plot the curve, Transmission vs. Mo Content. The graphical computation is the same as for High Mo Content.

Alternative slide rule method. If only the straight line portion of the graph is employed $y = sx$ where s = slope of the line, y = ordinate (transmission) and x = abscissa (Mo content). Choose a point on the curve, reading transmission and Mo content (t_1, m_1) and then choose another

point (t_2, m_2). Then $\frac{t_2 - t_1}{m_2 - m_1} = s$ is the slope of the line

Thus if the transmission of the test solution is read as 64% or 0.64, the 0.64 figure is divided by S . The quotient is the Mo content. The curve is not required. In setting the slide rule, "1/S" is set on the "D" scale, the "1" of the "C" is set opposite "1/S," then the glass slide, is set at the transmission value on the "C" scale. The Mo Content value is directly on the "D" scale.

Reagents

Sulfuric Acid. Place 500 ml. of distilled water in a 2 liter beaker. Set the beaker in a cooling bath. Add slowly and with stirring, 500 ml. of sulfuric acid (1.84 sp. g.).

Ammonium Thiocyanate. Dissolve 200 gm. in distilled water. Dilute to one liter.

Stannous Chloride. Place 350 gm. of $SnCl_2 \cdot 2H_2O$ in a 2 liter beaker. Warm with 200 ml. of hydrochloric acid (sp. g. 1.19) and 200 ml. of water. Add a little mossy tin. After solution, dilute to 1 liter.

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reduce hydrogen embrittlement. Yet recrystallization must be kept at a minimum to retain sufficient hardness.

Diffusion

In some cases a layer of metal is deposited on top of a layer of a second metal in order to produce an alloy by diffusion of one metal into another.⁷ By such a process indium is diffused into lead⁸ and zinc or tin are diffused into nickel.⁹

(To be continued)

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 Nachtman. Steel 104, 56 (June 12, 1939), deposited Ni-Fe before tin plating.
 W. J. Pinner. Monthly Rev. AES 29, 823 (1942).
 W. A. Wesley & E. J. Roehl. Month. Rev. AES 29, 909 (1942) studied reclaiming of nickel as nickel-iron alloy with iron anodes.
 A. H. DuRose & P. R. Pine. Reported that a Ni-Fe alloy containing 10 to

30% Fe offers better protection for steel in moisture laden atmosphere than Cd, Zn, Ni. Steel 114, 124, June 12 (1944).

Nickel-Copper Alloys

- Proctor. Trans. Electrochem. Soc. 23, 277 (1913) deposited Cu-Ni alloys.
 Hine & Cooley. Obtained copper-nickel alloys from cyanide solutions. Trans. Electrochem. Soc. 48, 61 (1925).
 C. G. Fink and F. A. Rohman. Trans. Electrochem. Soc. 57, 325 (1930) described the electrolytic elimination of copper from nickel solutions.
 R. B. P. Crawford & R. D. Snyder. Obtained a patent on Cu-Ni deposition from sulfate, oxalate, chloride borate, ammonia solution U. S. Pat. 1,750,092 (March 11, 1930).
 L. E. Stout, O. G. Burch, A. S. Langsdorf. Deposited Cu-Ni alloys containing 2 to 25% Ni from cyanide bath with low current efficiency. Trans. Electrochem. Soc. 57, 113 (1930).
 W. G. Parks & I. M. LeBaron. Trans. Electrochem. Soc. 70, 373 (1936) studied electrodeposition of Ni-Cu alloys.
 J. Kryzanovski and A. Gurewicz. Przemysl Chem. 21, 208-13 (1937); Chem. Abstr. 32, 7348 (1938) deposited NiCu alloy (10% Cu) from thiourea complex salt solutions.
 W. R. Meyer-A. Phillips. Deposited Cu-Ni alloys of low Ni content from cyanide solutions containing small amounts of nickel. Trans. Electrochem. Soc. 73, 377 (1938).
 D. C. Gernes & G. H. Montillon. Deposited copper-nickel alloys from thiosulfate solutions. Trans. Electrochem. Soc. 81, 231 (1942).
 O. P. Watts. Deposited Ni-Cu alloy ("Monel") of 48 to 86% Ni from alkaline citrate-acetate solutions with small amounts of cyanides present. Trans. Electrochem. Soc. 84, 348 (1943).
 Jacobs. J. Chem. Soc. 27, 972 (1905).
 E. P. Schoch & A. Hirsh. J. Chem. Soc. 29, 314 (1907); Trans. Electrochem. Soc. 11, 135 (1907).
 S. Glasstone. J. Chem. Soc. 130, 641 (1927), reported on electrodeposition of Ni-Zn alloys.

Nickel-Zinc and Nickel-Cadmium Alloys

White & Proctor. Chem. & Met. Eng. 34, 372 (1927).

O. J. Sizelove. Met. Ind. (N. Y.) 38, 180 (1936), reported on bright nickel deposits obtained after addition of small amounts of Cd.

Cocks. Reported on Ni-Zn alloy deposition. Trans. Faraday Soc. 24, 348 (1938).

J. H. Waite. Patented a bright nickel process from sulfate baths containing zinc or cadmium and an arylsulfonic acid. Deposit contains up to 4% zinc. U. S. Pat. 2,112,818 (March 29, 1938); 2,114,006 (April 12, 1938).

F. DeNora. Met. ital. 32, 187-92 (1940), Chem. Abstr. 36, 5711 (1942), studied influence of several variables on Ni-Zn alloy deposition.

Standard Steel Spring Co. Brit. Pat. 548,148 (Sept. 29, 1942), described Ni-Zn alloy deposition (3.24% Ni).

B. Lustman. Studied deposition potential, composition, microstructure, banding of Ni-Zn alloys (0-100% Ni). Trans. Electrochem. Soc. 84, 365 (1943). See also Nickel-Sulfur, Nickel-Zinc-Sulfur.

Nickel-Lead Alloys

Anonymous. Brass World 20, 416 (1924), proposed the addition of lead as a brightener in nickel plating in presence of citrate.

E. Raub & M. Wittum. Studied co-deposition of lead with nickel. Korrosion und Metallschutz 13, 261 (1937).

W. L. Pinner & C. C. DeWitt. Obtained a patent on electrodeposition of Ni-Pb alloys of improved brightness and buffability. U. S. Pat. 1,837,835.

E. M. Baker. U. S. Pat. 2,312,517, described electrodeposition of ductile Ni-Pb alloys in presence of sodium formate.

Nickel-Chrome Alloys

G. L. Wallace. From nickel sulfate and chromium carbonate, anodes 25% Cr. U. S. Pat. 1,948,145 (Feb. 20, 1934).

M. F. Skalozubov and A. S. Vlasova. Izvest. Novoherkassgogo Ind. Inst. im. S. Ordzhonikidze 6, Ser. Khim. 15-18 (1940); Chem. Abstr. 35, 1323 (1941), deposited a protective Cr-Ni alloy from a solution containing chromic acid 250, nickel sulfate

250, boric acid 25 g./l. at 30-35 amp./sq. dm. and 35-40° C.

Nickel-Silver Alloys

Proctor. Metal Ind. (N. Y.) 9, 395 (1911); 18, 13 (1920), electrodeposited Ni-Ag alloys.

A. Marino. French Pat. 668,800 (May 18, 1928), deposited Ag-Ni from cyanide and other baths.

K. Masaki. Bull. Chem. Soc. Japan 7, 158 (1932); C. A. 26, 4540 (1932).

H. Behnke. Deposited a nickel-silver alloy from cyanide solutions as an intermediate layer between nickel and silver plate, Oberflaechen Technik. 13, 183 (1936).

F. C. Mathers & A. D. Johnson. Trans. Electrochem. Soc. 74, 229 (1938), deposited Ag-Ni (up to 5% Ni) from thiocyanate bath.

Nickel-Gold Alloys

Raub & Bihlmaier. Mitt. Forsch. Inst. Probieramts Edelmetalle Schwab. Gmund. 11, 59 (1937).

J. B. Kushner. Products Finish. 4, No. 12, 32 (1940).

C. B. F. Young & V. E. Herschlag. Metal Finish. 38, 194 (1940), deposited Au-Ag-Cu-Ni alloys.

H. J. Kersten. U. S. Pat. 1,924,439 (August 29, 1933), described plating of "white gold" from a solution containing potassium gold cyanide and nickel formate.

Nickel-Manganese Alloys

G. B. Hogaboom, Sr. Reports that manganese decreases crystal size of nickel deposit. Discussion Trans. Electrochem. Soc. 84, 314 (1943).

Nickel-Molybdenum Alloys

R. A. Hoffman. U. S. Pat. 2,380,044 (July 10, 1945).

R. A. Hoffman & R. O. Hull. Proc. A. E. S., June, 1939.

C. B. F. Young. Iron Age 149, 53, Feb. 12, 1942, described electrodeposition of black molybdenum finishes consisting of nickel and a molybdenum oxide (10% Ni, 45% Mo).

Nickel-Sulfur and Nickel-Zinc-Sulfur Deposits

D. C. Gernes & G. H. Lorenz & G. H. Montillon. Obtained sulfur-contain-

ing nickel deposits (more than 22% S), probably as Ni_3S_2 from thiosulfate solutions. Trans. Electrochem. Soc. 77, 177 (1940).

C. H. Proctor. Metal Ind. (N. Y.) 5, 18 (1907), and 16, 26 (1918).

O. P. Watts. Metal Ind. (N. Y.) 12, 24 (1914).

G. B. Hogaboom, T. S. Slattery & L. B. Ham. Monthly Rev. A.E.S. 6, 14 (July, 1919).

Bureau of Standards. Tech. Paper 190. J. Haas. Metal Ind. (N. Y.) 19, 23 & 73 (1921).

J. L. Downes. Monthly Rev. A.E.S. 22, 17 (Aug. 1935).

A. J. West. Met. Ind. (London) 54, 253 (1939).

C. B. F. Young. Iron Age 149, 46, Feb. 19 (1942).

W. E. Moline. Proc., A.E.S. 21 (1943).

J. G. Poor. Metal Finish. 41, 694 & 769 (1943).

E. Schore. Metal Finish. 41, 77 (1943).

Nickel-Selenium or Tellurium Alloys

W. J. Harshaw & K. E. Long. U. S. Pat. 2,125,229 (July 26, 1938).

H. G. Mongey & R. J. Wirshing. U. S. Pat. 2,338,529 (Jan. 4, 1944), obtained bright nickel deposits by addition of small amounts of selenium or tellurium.

Nickel-Thallium Alloys

H. Brown. U. S. Pat. 2,402,801, obtained brilliant, ductile deposits from nickel solutions containing up to 1 g./l. thallium sulfate and an aromatic sulfimide or sulfonamide. A high concentration of thallium, like that of zinc or cadmium, causes the deposits to be exceedingly brilliant, but hard and brittle and produces dark deposits in low current density areas.

Nickel-Tin Alloys

R. G. Monk & H. J. T. Ellingham. Deposited Ni-Sn alloys with 22-25% Ni from stannate bath, Ni-codeposition hardens deposit considerably. Trans. Faraday Soc. 31, 1460 (1935) and Techn. Pub. Internat. Tin. Research Devel. Council No. 25, Series A.

F. F. Oplinger. U. S. Pat. 2,085,543 (June 29, 1937), described deposition of Sn-alloys containing small amounts of Ni, Co, Cu, Ag.

Nickel-Tantalum and Nickel-Tungsten Alloys

H. H. Armstrong & A. B. Menefee. Brit. Pat. 477, 519 (Dec. 24, 1937); U. S. Pat. 2,149,657 (March 7, 1939); U. S. Pat. 2,160,322 (May 30, 1939); German Pat. 654,270 and 683,879.

Nickel-Tungsten Alloys

C. G. Fink & Jones. Trans. Electrochem. Soc. 59, 461 (1931), deposited Ni-W alloys containing up to 50% Ni from tungstate solution in presence of organic acids.

L. N. Goltz & V. N. Kharlamov. Deposited Ni-W alloys from ammonium tungstate solutions. J. Appl. Chem. (U.S.S.R.) 9, 652 (1936); C. A. 30, 7460 (1936).

M. L. Holt. Deposited W-Ni alloys from tungstate solutions. Trans. Electrochem. Soc. 66, 453 (1934); ibid. 71, 301 (1937).

M. L. Holt & M. L. Nielsen. Plated Ni-W (5-10% W) from Watts solution and sodium tungstate. Trans. Electrochem. Soc. 82, 193 (1942).

C. G. Fink and C. G. Fink & F. L. Jones. Deposited W and W-Ni alloys from tungstate solutions. U. S. Pat. 1,885,700-702 (Nov. 1, 1932).

H. H. Armstrong & A. B. Menefee. U. S. Pat. 2,143,853 (Jan 17, 1939); U. S. Pat. 2,145,241; 2,145,746 (Jan. 31, 1939); 2,149,656-8 (March 7, 1939); 2,160,321-22 (May 30, 1939); Brit. Pat. 460,840; Can. Pat. 379,321; French Pat. 789,833. Deposited W-Ni alloys from acid fluoride, phosphoric acid, organic acid baths.

Miscellaneous Nickel Alloys

G. Bruni and M. Amadori. Atti Accad. Sci. Lett. ed. arti, Padova 30, 349 (1913-14); Chem. Abstr. 9, 1432 (1915), described deposition of Ni-Cu, Ni-Fe, Ni-Co alloys.

P. Marino. Brit. Pat. 10, 133 (July 12, 1915); Chem. Abstr. 11, 121 (1917), deposited nickel and various nickel-alloys from solutions containing sodium pyrophosphate, phosphoric acid and sulfanilic acid.

Siemens and Halske. A. G. Brit. Pat. 286,457 (March 8, 1927), deposited Cr, Ni, Mo, W alone or simultaneously from molten borate, sulfate, silicate, cyanide baths.

L. E. Stout. Washington Univ. Studies, Sci. Tech. (N. S.) No. 6; 9-37 (1932); Chem. Abstr. 26, 5263 (1932), reviewed previous work on Ni-Cu, Ni-Fe, Ni-Cu-Fe alloy deposition.

E. D. Viers & B. C. Case. Obtained a patent an electrodeposition of thick pit-free nickel plate with additions of Zn, Sn, Co, Pb, Cd and an organic agent from sulfate type bath. U. S. Pat. 2,119,304 (May 31, 1938) and 2,183,384 (Dec. 12, 1939).

W. Wilmer. Deposited Ni-Cd, Ni-Co, Ni-Fe alloys. Oberflächentechnik 225 (1931).

N. A. Izgaryshev and Kh. M. Ravikovich. J. Gen. Chem. (U. S. S. R.) 9, 1443-55 (1939); Chem. Abstr. 34, 2714 (1940), described electrodeposition of Cu-Ni, Ni-Zn, Cu-Ni-Zn alloys from sulfate solutions containing boric acid and gum arabic or cresolsulfonic acid.

Ternary Alloys

Ni-Fe-Co Alloys. Deposited from sulfate-fluoride-boric acid baths by *R. M. Burns.* U. S. Pat. 1,920,966 (Aug. 8, 1933).

Cu-Ni-Fe Alloys. Deposited from cyanide or ammonium borocitrate-sulfate baths by *L. E. Stout & C. L. Faust.* Trans. Electrochem. Soc. 60, 271 (1931); 61, 341 (1932); 64, 271 (1933).

Au-Cu-Ni Alloys. Deposited by *J. Winkler.* U. S. Pat. 1,951,893 (Mar. 20, 1934), by application of a periodically varying direct current.

Cu-Ni-Zn Alloys. Deposited by *C. L. Faust & G. H. Montillon* from cyanide solution at low current efficiency; less protective than zinc alone. Trans. Electrochem. Soc. 65, 361 (1934); 67, 281 (1935); 73, 417 (1938); Metal Cleaning Finish. 8, 319 (1936). *H. Paweck, J. Bauer, J. Dienbauer.* Sulfate-citrate baths. Z. Elektrochemie 40, 857 (1934).

Ni-Cu-W Alloys. Techn. Z. Prakt. Metallbearbeitung 48, 178 (1938).

Ni-Co-W Alloys. Deposited from sulfate, chloride, boric acid and sodium tungstate, no special corrosion resistance. *P. F. Hoglund & M. L. Holt.* Trans. Electrochem. Soc. Preprint 88-24, 1945.

Ni-Cr-W Alloys. Alloys containing 1-40% Cr, 1-40% W were deposited

by *G. Fuchs.* Brit. Pat. 397,788 (Aug. 31, 1933); Chem. Abstr. 28, 978 (1934).

Ni-Cr-Fe Alloys. Deposited by *M. P. Skalozubov and I. A. Goncharov.* Izvest. Novoherkasskogo Ind. Inst. im. S. Ordzhonikidze, 6, Ser. Khim. 24-8 (1940); Chem. Abstr. 35, 1323 (1941), from a bath containing chromic acid 250, nickel sulfate 250, ferrous sulfate 175, boric acid 25 g./l. at 50 amp./sq. dm. and 60° C. *E. Imbusch.* Ger. Pat. 742,907 (Oct. 28, 1943); Chem. Abstr. 40, 525 (1946), described electrodeposition of austenitic Cr-Ni Steel on artificial dentures.

M. L. Freed. U. S. Pat. 2,228,991 (Jan. 14, 1941), described bright nickel plating from baths containing cobalt and one or more of the metals cadmium, zinc, mercury.

See also Nickel-Tantalum and Nickel-Gold Alloys.

Alloying After Plating

V. L. Lanier and E. G. Shatunovskaya. Korroziya i. Borba s Nei 4, No. 1, 3-20 (1938); Chem. Abstr. 33, 919 (1939), heat treated and examined Ni-Cu, Ni-Cu-Ni, Ni-Cu-Ni-Cu plates.

R. Rimbach. Metal Finish. 39, 360 (1941), described "Corronizing" 0.00009" nickel followed by 0.00012" zinc and heat treatment (500 to 750° F.) is equivalent to 0.0022" zinc alone in 500 hr. saltspray test.

H. R. Copson & W. A. Wesley. Recommended on steel; nickel plating then tin plating followed by heat treatment. The coatings were anodic to bare steel in four or five foods tested. Potential substitute for heavier tin coatings. Trans. Electrochem. Soc. 84, 211 (1943).

C. G. Fink and H. B. Osborn, Jr. Trans. Electrochem. Soc. 86, 262 (1944), recommended alloying by induction heating of a deposit with basis metal or of alternate Cu and Ni plates.

J. M. Schoonmaker and F. Stockton. U. S. Pat. 2,381,778 (Aug. 7, 1945), described electrodeposition of nickel followed by tin and heat treatment.

G. Black. Metal Finish. 44, 207 (May 1946), gave microphoto and corrosion data of diffused Ni-Zn coatings. "Corronizing" covers two types of metal coatings, namely Ni-Zn and Ni-Sn, the latter being applied chiefly in the food container field.

BRIGHT DIPPING

By GUSTAF SODERBERG

This paper defines bright dipping, reviews existing bright-dipping processes for copper and its alloys, cadmium plate and zinc plate, magnesium and lead. Applications are listed and discussed. A theory of bright dipping, paralleling that for anodic brightening, is proposed.

BRIGHT dipping may be defined as a corrosion process whereby the percentage of specular reflectance from a metallic surface is increased without the application of an outside electromotive force.

So called "electropolishing" accomplishes the same purpose with the application of an electromotive force sufficient to polarize the article anodically.

Pickling or acid dipping may increase the total reflectance by removal of dark oxide film but tends to roughen the surface and decrease the percentage of specular reflectance.

Uses

The purpose of bright dipping may be to improve the surface appearance of an article, or to prepare the surface for a subsequent treatment such as plating, or to passivate the surface to prevent subsequent corrosion and discoloration and improve paint adhesion. Bright dipping is also used to remove a peculiar crystal growth which appears on surfaces which are cadmium plated at very low current densities. Such growth will at times develop at the bottom of variable radio condensers, made of brass, and give rise to short circuiting one plate to the other.¹

Bright dipping is used primarily on solid copper and brass and on electroplated coatings of zinc, cadmium, copper and brass. No commercial bright dipping of magnesium and lead are known.

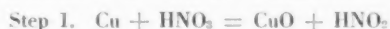
Bright Dips for Copper and Copper Alloys

Copper, bronze and brass are frequently bright dipped in the time-honored nitric-sulfuric-muriatic acid bath. Graham² recommends for bulk dipping as the final bright dip a composition of 800 g./L. H₂SO₄ (Sp. gr. 1.84); 100 g./L. HNO₃ (Sp. gr. 1.38); 25 g./L. HCl (Sp. gr. 1.17); and 491 g./L. H₂O at a maximum of 35° C (91° F). In this dip the function of the hydrochloric acid is to decrease slightly the attack on the copper and to increase sharply the attack on zinc. The nitric acid functions in the opposite manner. The attack on both alloy constituents increases with increasing sulfuric acid content up to about 550 g./L. then decreases as the sulfuric acid content

is increased further. Increasing temperature causes the attack on copper to increase sharply and that on zinc to decrease slightly up to about 50° C (122° F), above which the trends are reversed. The color and the brightness can most readily be controlled at a temperature not exceeding 35° C (95° F) above which a smoky color develops.

Since much heat is evolved in the bright-dip reaction and since relatively minor changes in composition of the bath affect the color produced it is common practice to do the necessary surfacing in a preliminary dip. This so-called "scaling dip" contains less sulfuric acid and is therefore more active than the regular bright dip. A typical analysis is 700 g./L. conc. H₂SO₄, 100 g./L. conc. HNO₃, 5 g./L. conc. HCl and 544 g./L. H₂O. The time of immersion in this dip is long enough to produce the desired smoothing of the surface at whatever temperature is reached. The optimum color is then brought out in the regular bright dip in a few seconds.

Hedges³ comments on the observation that copper is only very slowly attacked by nitric acid free from nitrous oxides and proposes the following as the likely reactions:



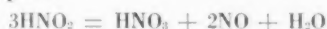
Steps 2.



Step 3.



Steps 4.



Larsen⁴ states that the bright-dipped parts must be surrounded by nitrous gases on transfer to the subsequent rinsing operation and that access of air, common in automatic handling, causes discoloration. To overcome this effect he proposes the use of H₃PO₄ in the bath, his preferred bath composition being 50% sulfuric acid, 36% nitric acid and 14% phosphoric acid.

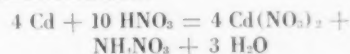
Meyer and Dunleavy⁵ add chromic acid to inhibit the evolution of nitrous gases (thus decreasing health hazards) to reduce the reaction rate, making it possible to transfer the dipped parts more slowly and with less drag-out loss, and to passivate the metal. Their preferred solution contains 80 cc. H₂SO₄, 20 cc. HNO₃, 1 cc. HCl, 55 to 60 g. CrO₃ and 200 cc. of water. This type of bath has been used widely during the war, espe-

cially in automatic operations. It is also particularly suitable for use on thin, plated coatings.

Bright Dip for Cadmium, Zinc and Magnesium

The following bright dips for zinc plate and cadmium plate are generally adjusted for operation at room temperature to produce the desired brightness on a smooth electroplate in a few seconds, or up to less than one-half minute, without the removal of more than a very small percentage of the electroplates. Magnesium, which also belongs to the IIb group of the periodic table, may be bright dipped in some of these same solutions.

Nitric Acid Solutions. Ganser⁶ proposed an aqueous solution of 0.5% to 1% by vol. conc. HNO₃ for cadmium. Unfortunately the discoloration of cadmium-plated parts packed closely together is accelerated when this dip has been used, probably due to the formation of ammonium salts.⁷



A weaker dip containing 0.25% to 0.5% by vol. conc. HNO₃ has been used very successfully on zinc plate,⁸ being less sensitive than several other dips to the presence of such impurities as copper in the plate.

Chromic Acid Solutions. The chromic acid dips developed by Dubernell and Soderberg,^{7,9} overcame the tarnishing of cadmium-plated parts packed closely together and provided considerable passivity¹⁰ which even has some value in outdoor exposure.¹⁰ These dips contain, besides chromic acid, a relatively small amount of sulfuric, hydrochloric or nitric acids. With large amounts of the mineral acids a yellow to brown protective film is formed which is known as "cronak" and has large commercial use.¹¹ When applied under proper conditions it can, if desired, be removed by either acid solutions of pH ≤ 2.68 or alkali hydroxide solutions ≤ 4.25 N, leaving a brightened but active surface on the zinc or the cadmium plate.

Preferred Solutions the use of which does not require after-treatment are: for cadmium "rack work," 100 g./L. CrO₃ and 1.67 g./L. H₂SO₄; for cadmium "barrel work" 100 g./L. CrO₃ and 1 g./L. H₂SO₄. A suitable solution for brightening zinc plate contains 300 g./L. CrO₃ and 5 g./L. H₂SO₄. Meyer and Dunleavy¹² recommend for zinc 200 g./L. CrO₃, 15 g./L. Na₂SO₄ and 52.5 g./L. HNO₃. Ostermann¹³ uses a solution containing, by weight 25% CrO₃, 10% HCl and 65% H₂O for zinc alloys containing copper. He rinses in water and then immerses in a 10% CrO₃ solution until the slight coloring produced in the first solution disappears.

The reactions during bright dipping in chromic acid solutions include the formation of the salts of the metal and chromic salts, the accumulation of both of which can be tolerated as long as the CrO₃ content of the dip is maintained at the relatively high initial value.

Hydrogen Peroxide Solutions. Acidified

* The word "passivity" is used throughout this paper to designate the presence on a metal surface of a visible or invisible film which reduces the reactivity of the surface in any corrosive medium.

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hydrogen peroxide solutions are being used for bright dipping of both cadmium¹⁴ and zinc¹⁵ plates. A number of acids may be used for acidification, including sulfuric, hydrochloric, perchloric, fluosilicic, formic, acetic and dichloroacetic acids, as long as certain proportions are used. Hull¹⁵ claims for zinc 2% to 8% by weight hydrogen per-

oxide at a pH equals approx. $\log_{10} \frac{360}{\%H_2O_2}$ to $\log_{10} \frac{50}{\%H_2O_2}$.

Preferred formulas are: for cadmium 7% by vol. of 30% hydrogen peroxide with 0.3% by vol. H_2SO_4 (Sp. gr. 1.84)¹⁶; for zinc⁸ 4% by wt. H_2O_2 and 0.25% by wt. H_2SO_4 .

The hydrogen peroxide bright dips have the advantage that the reaction products are water and the metal salts, which latter can be tolerated in large amounts. However, the passivation afforded is less pronounced than that produced in chromic acid solutions. Also, impurities in the electroplate are more likely to cause discoloration of the final finish than in the case of the nitric acid bright dip on zinc and the chromic acid bright dip on either cadmium or zinc.

Bromic Acid Solutions. Stockton¹⁷ found that the oxy-acids of the pentavalent halogens, especially 0.1 N to 0.76 N bromic acid, brighten cadmium.

Bright Dip for Lead

It has been observed that the aqueous solution containing 3.5% by vol. of 30% hydrogen peroxide and 3.5% by vol. of glacial acetic acid, when used as a dropping-test reagent for lead plate,¹⁸ causes periodic brightening and darkening of the lead. It is possible that a slight decrease of the acid content would give a satisfactory bright dip.

Theoretical

How are we to interpret the two phenomena of the bright dips, the brightening effect and the smoothing effect? The interpretations we offer here are based on the characteristics of all known bright dips: their rapid attack on the metal and their strongly oxidizing character which permits attack without hydrogen gas evolution. These characteristics remind one of the conditions existing in anodic brightening of metals, a resemblance which was pointed out by Kutzelnigg in his discussion of Jacquet's paper¹⁰ on "electropolishing" of copper.

The Brightening Effect. It is well known that in ordinary pickling of metals, grain boundaries and certain crystal faces which have a slightly higher solution potential than the remainder of the surface are attacked preferentially. The same sort of selective etching and roughening of the surface takes place on low current density anodic corrosion when only concentration polarization exists.

When this author first tried to explain the brightening effect⁷ he suggested that the brightening was a selective attack on crystal faces perpendicular to the surface. The fact that a cold-rolled brass surface with highly disorganized grains is easily bright dipped speaks against this view. On the contrary, it is now believed that the solution of the metal, in bright dipping as well as in anodic

brightening, takes place at such a high potential that the small differences in solution pressure on the surface of the metal are completely overshadowed. As long as there are no undissolved residues on the surface, this condition would permit the true metal color to show all over and not only on selected crystal faces as in etching.

The Smoothing Effect. To obtain specular reflection we must produce not only a bright surface but also one which is smooth. This is a time-consuming operation when existing microprotrusions must be dissolved away at a higher rate than microdepressions. It is well recognized in the art that, in order to keep the time of bright dipping of zinc and cadmium electroplate at a minimum and to avoid excessive removal of metal from an originally thin electroplate, this plate must be smooth before bright dipping. Therefore, these metal coatings are generally produced in plating baths containing addition agents and the bright dip fulfills only an auxiliary function.

Jacquet¹⁹ bases the smoothing in anodic brightening upon his observation that the surface during electropolishing is covered with a *highly viscous liquid film* of corrosion products dissolved in the electrolyte. This film is naturally much thicker in the microdepressions than on the microprotrusions. Since this film has a high electric resistance, the current will concentrate on the microprotrusions, causing them to dissolve preferentially. A similar explanation may be applicable to chromic acid bright dipping in which a highly viscous chromic bichromate film is probably formed during the reaction. One may well picture the greater ease with which fresh bright-dipping solution would diffuse to microprotrusions than to microdepressions. One can possibly imagine a similar film mechanism in the case of the concentrated brass bright dips, but a viscous film does not seem very likely in the case of the dilute nitric acid and the hydrogen peroxide bright dips.

U. R. Evans in the discussion of Jacquet's paper¹⁹ points out that the existence of *solid films* would also explain the smoothing effect. When formed under conditions which are intermediate between those producing total activity and total passivity, they would be thicker in microdepressions than on microprotrusions. Evans then refers to the work by Pilling and Bedworth²⁰ who found that solid films of corrosion products are more compressed on the concave surfaces of microdepressions than on the convex surfaces of microprotrusions and hence that it is easier to pull a metal atom through the latter film than the former.

This explanation seems generally applicable to smoothing by bright dipping. Kutzelnigg¹⁹ found films of $CuSO_4 \cdot 5H_2O$ on copper which had been bright dipped in sulfuric-nitric acid solution. The existence of passive films on chromic acid bright-dipped surfaces has been described above. Oplinger^{14, 15} and Hull¹⁵ describe hydrogen peroxide bright-dipped cadmium and zinc plates as passive although not passive enough to interfere with subsequent nickel plating. Furthermore, Kutzelnigg²¹ has shown that the rate of attack on

copper in sulfuric-nitric acid bright dips decreases with increasing time of immersion. The same situation has been observed by the writer and his former co-worker, D. B. Stockton,²² in the case of zinc plate in chromic-sulfuric and in nitric acid bright dips and in the case of cadmium and zinc plate in hydrogen peroxide-sulfuric acid bright dips. No contrary results were ever obtained. One may conclude, therefore, that the observed films caused at least some passivation in the media in which they were formed.

That these films are formed under conditions which are intermediate between full passivity and full activity is suggested by the behavior of lead in hydrogen peroxide-acetic acid solution mentioned above. D. B. Stockton and his author found similar periodic brightening and whitening of cadmium electroplate in chloric acid¹⁷ and of cadmium and zinc plates in hydrogen peroxide solutions containing a slight excess of the several acids used. The same periodicity appears in anodic treatment of zinc and cadmium plates in their cyanide plating solutions at current densities slightly below those required for consistent brightening. This parallelism between the slightly low anode current density in electroplating and the slight excess of acid or a slight deficiency of hydrogen peroxide in bright dipping is evident. We might conclude, therefore, that fundamentally the same or similar electrochemical phenomena take place in bright dipping as in anodic brightening.

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- ¹⁸ A.S.T.M. Designation: ES-31, Am. Soc. Testing Materials, Standards, Part I, 1944, 1061.
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- ²⁰ N. B. Pilling and R. E. Bedworth, J. Inst. Metals, **29**, 529 (1923).
- ²¹ Arthur Kutzelnigg, Z. Elektrochem. **39**, 6 (1933).
- ²² The Udylite Corporation, Chicago, Ill.

SHOP PROBLEMS

PLATING AND FINISHING
POLISHING—BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Bright Dip Container

Question: Will you kindly advise us what sort of a container you would recommend for a bright dip solution where we use two parts sulphuric, one part nitric and 15% water?

We have been using a crock which has a tendency to crack under heat, etc., and we would like to have something more substantial.

M. Y. N.

Answer: If heat resistant, ceramic ware is used instead of an ordinary crock, you will eliminate the tendency of cracking. Such ceramic ware may be obtained from the U. S. Stoneware Company, Talmadge, Ohio.

Stainless steel may be employed as a container for the bright dip if the welding is properly performed.

Recessed Parts Drying

Question: We have the problem of drying, after pickling, a brass part which has very deep recesses. The method used in the past has been to handle each piece individually and blow out with a jet of air. However, with increased production requirements, we are looking for a means of doing this without individual handling. To accomplish this we have been advised to rinse the part in a mixture of plater's compound and caustic soda in dilute solution. This, we are told, will prevent staining, and we may dry more slowly than would otherwise be necessary.

We would like to know what plater's compound is and where it can be obtained, and would also appreciate any suggestions you have that would help in the solution of our problem.

W. R. V.

Answer: We believe that by "plater's compound," you mean an alkaline

cleaner. A film of alkali may be suitable for this purpose but we would suggest that you use 1/10-1/14 oz./gal. of a neutral soap in the hot water rinse.

Proprietary chromate solutions for tarnish prevention may be obtained from: Special Chemicals Corp., 30 Irving Place, N. Y. C., and Frederick Gumm Chem. Co., Kearny, N. J.

Plating Soldered Brass

Question: Please send me any information you have on oxidizing soft solders on brass, 70 per cent copper, 30 per cent zinc. I wish to oxidize the entire article to one uniform color without plating. If this cannot be done, what is the simplest and quickest way to obtain a uniform gold color on the brass and the soft solders with a limited amount of work? My work is done exclusively on brass.

N. R. P.

Answer: It will be necessary to brass plate since a gold color cannot be produced on a soldered surface by dipping. After brass plating, you may produce a gold color by using a tinted lacquer or clear lacquer followed by a gold dye, both of which are obtainable from lacquer manufacturers.

Deposition of Aluminum

Question: Would appreciate you giving us all the information available on electroplating of aluminum. It is our desire to plate aluminum directly on steel and we cannot find the information necessary on the installation of baths.

H. E. B.

Answer: There is no commercial method for producing this finish. The aluminum coated steel sheet on the market today is produced by hot dipping.

Black Nickel Plating

Question: I observed an article by J. G. Poor, in *Metal Finishing*, November, 1943, page 964 and page 676 on "Black Nickel Plating."

A friend of mine desires to electroplate several of his guns with a black adherent coating—especially black nickel. I do not know about the adherent aspects of this coating and would appreciate some information on it.

H. R. H.

Answer: Black Nickel plating is not suitable for guns. The usual finish is the black oxide type, produced in a solution of caustic soda and as an oxidizing agent. A large number of firms furnish proprietary materials for this purpose and you can refer to those listed on the attached tear sheet from our 1946 Buyers' Directory.

Silver Recovery

Question: I am interested in recovering the silver from a discarded cyanide plating solution containing approximately 3 oz. metallic silver per gallon.

What per cent of the silver should one be able to recover and what would you recommend as the most practical and economical method of recovery?

E. C.

Answer: The silver may be plated out, using steel anodes or can be precipitated with zinc dust. Either method will give very high recovery of silver.

If you use the latter method, add three ounces per gallon of zinc dust, one ounce at a time, stirring thoroughly.

Excess zinc in the mud can be removed with dilute hydrochloric acid after the cyanide solution has been washed out.

Pickling Lead Castings

Question: Can you advise us the formula of an acid dip that will give a clear metal finish on lead castings?

Sulfuric and muriatic acid we have experimented with but this in turn

gives a black oxide which is very objectionable.

We understand there are certain formulas used for this purpose containing portions of acetic acid, etc., which will do the work satisfactorily.

P. J. S.

Answer: Mixtures of acetic acid and hydrogen peroxide may be employed for this purpose. We would suggest that you try a solution containing 10% by volume each, of hydrochloric acid and 30% hydrogen peroxide varying this formula as required for the particular alloy being used.

Electropolishing Silver

Question: We believe that you can give us information regarding suitable solutions for electropolishing silver.

If you can give us this information or the name of a firm that would be in a position to help us, we would appreciate it.

J. M. G.

Answer: According to Gilbertson and Fortner (Trans. Electrochem. Soc., 81, preprint 5, 1942) the following solution may be used:

Silver cyanide 33 g.l.
Free potassium cyanide 50-100%
Potassium carbonate ... 33 g.l.
25° C., 1-9 mins.; 3-8 amp./sq. ft.

Silver Plating

Question: We have not been able to get good results from the mercury dip which we have been using, and would appreciate any information you might have on silver plating. If you do not have the information on this process, could you give me the name of some one who could help me?

R. B. A.

Answer: We do not recommend a mercury dip because it causes cracking of brass. We would suggest that you use the silver strike formula which will be found in the *Plating and Finishing Guidebook*.

Depositing Chromium

Question: Can you tell us where we can get some information that will aid us in chromium plating flat surfaces? We have been attempting to plate a flat surface 18" square, but haven't had too much success in throwing the chrome into the center. It isn't necessary that it be evenly deposited as to thickness, but we want to cover the whole thing. Any suggestions as to

whom we might contact for information in this connection will be appreciated.

H. D.

Answer: Assuming that the solution is in satisfactory condition, poor cover-

age will result if the sheet is too thin in cross section to carry the required number of amperes. If this is the case, we would suggest that you make contact either in the back of the sheet at a few points or at all four corners,

ORDINARY NICKEL PLATING FAULTS

Metal Finishing presents the following chart of daily ills in nickel baths together with reasons and corrective measures:

<i>Nickel</i>		
<i>Fault</i>	<i>Reason</i>	<i>Correction</i>
Dark or black colored deposits.	Bath is alkaline.	Add sulphuric acid to adjust pH.
	Bath contains copper.	Plate out on scrap metal.
Porous deposits.	Impure basic nickel salts.	Add ammonium sulfate.
Bright streaks and pitting.	Impure solution due to zinc.	Neutralize impurity with either calcium carbonate, calcium hydroxide, or ammonium hydroxide.
Black streaks and pitting.	Impure solution due to large quantities of zinc.	Filter and adjust pH with sulfuric acid.
Brittleness and pitting.	Impure solution due to organic matter.	Transfer filter, clean tank, add potassium permanganate, adjust pH with sulfuric acid.
Roughness, porosity and pitting.	Impure solution due to solid matter.	Transfer filter, clean tank.
Pitting.	Insufficient anode area.	Add anodes.
	Low nickel content.	Add nickel salts.
	No agitation or insufficient agitation.	Increase agitation.
	Impure solution due to colloidal matter	Add hydrogen peroxide, sodium peroxide, sodium perborate, sodium fluoride or potassium permanganate in small amounts, adjust pH.
	Incorrect pH value.	Adjust pH.
Bright brittle peeling.	Bath is acid.	Adjust pH.
	Low nickel content and high in conducting salts.	Add nickel sulfate.
Dark brittle peeling.	Bath is alkaline.	Adjust pH with sulfuric acid.
Blistering.	Unclean work, unclean rinse water, or acid dip is dirty or weak.	Correct cleaning cycles.
Poor anode corrosion.	Insufficient chloride present.	Add nickel chloride.
High anode corrosion.	Excessive current.	Lower current or add more work surface with same current.

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent



America Is Calling Metal and organic finishing are important industries but they are not big in the same sense that are such primary ones as the transportation, automotive, coal mining and iron and steel industries. Instead they are secondary services which depend upon the affairs of the primary industries. When the automotive industry is plagued with strikes the volume of electroplating and organic finishing drops; when the iron, steel and coal mining industries are having labor trouble the terneplate, tinplate, galvanizing and other services are slowed up; and when the transportation industry is tied up by a struggle between capital and labor, the organic finishers and electroplaters experience difficulties in securing supplies to carry on their operations.

This makes it apparent that the metal and organic finishing industries cannot be indifferent about what is going on in the present labor-management-government disputes, for the decisions made as a result of these fights not only affect the metal finishing industries but also affect the destiny of the United States.

In one way the present position of Uncle Sam is like a large woman boarding a street-car with a squalling baby in one arm and a basket of lunch in the other. Two youngsters are clinging to her skirts; two others are having a free-for-all fight; a sixth is pulling the trolley off the wire, and another grabs the conductor's change maker.

The conductor in exasperation asks: "Madam are all of these your children; or is this a picnic?"

Puffing and pulling the woman replies: "Sir, they are all my children; and it is no picnic."

The children of that woman symbolize the fruits of some seeds sown by the post 1933 labor policies and by the lovers of government paternalism.

And now the creators of the sugar coated slogan, "a strong, progressive and humane government," who put the people of the United States into the present kettle of instability soup, are seeking to do more "economic planning" to accomplish what they call "full employment."

From the housetops the panic experts shout their gospel of fear of free enterprise to the gullible public. And without telling the public where the money is coming from, they suggest that prosperity and economic security can be guaranteed to each individual if the government is given the power to control prices, wages and other things.

Every schoolboy knows that we already have laws which provide the United States Government with power to control production, distribution, prices and wages. And every person of sound mind knows that these laws have not given the people of the United States economic stability or peace of mind.

Everywhere one sees how employers are caught on one side by collective bargaining and price control of the Wagner and Emergency Price Control Acts, and on the other side by Director of Economic Stabilization John R. Steelman, the National Wage Stabilization Board, and a number of other agencies with regulatory powers.

President Truman talks about holding prices and wages and his appointees nearly always yield to the demands of organized labor, so much so, that some persons are asking if the unions are trying to usurp Government authority. And to add flavor to this chaos of Janus talk and actions, the public witnesses the spectacle of Byrnes, Truman and Wallace fighting like three tom-cats in a political barrel.

All of this talking, fighting, speech making, approving, amending, and denying reminds one of an observation made by Charles Dickens in his *Pickwick Papers* in which after Mr. Nupkins makes a speech he has Sam Weller remark that Mr. Nupkins' ideas came out so fast that they knocked each others heads off and no one knows what he is talking about.

When the Wage Stabilization Board refused to meet the demands of the seamen of the American Federation of Labor, William Green declared that "the Wage Stabilization Board stands repudiated and disgraced." And to strengthen this position both William Green and John L. Lewis strongly favored the withdrawing of AFL representation on the Wage Stabilization Board.

To appease the members of the American Federation of Labor, and to "save face" in the Government's break-down to maintain wage control, Economic Stabilization Director John R. Steelman dug up an old law of 1862 which provides that the Government shall pay workers the "prevailing" wage when it hires workers in a given industry.

Steeleman's statement strengthened the belief of union leaders that they can force a liberalization of wage stabilization. The strike of the CIO seamen, right on the heels of the Steelman statement, is evidence of this belief. And it is not unlikely that all unions which were granted increases of 18 cents an hour during the past year will soon come knocking at the front door for another increase in wages.

In preparation for the new demands and the flood of strikes which some believe will sweep the country following the November elections, the CIO is conducting intensive research on inflation trends to unearth evidence to promote a basic shift in the union's wage policy.

In this three cornered struggle between management, labor and government, there is real rivalry between the AFL and the CIO for the honors of abolishing the very much weakened Wage Stabilization Board. The United Mine Workers Journal said

that it is opposed to "an un-American bureaucratic plan that the wages of American workers should be controlled by Government fiat," in referring to the Wage Stabilization Board.

Harry Lundberg, the AFL leader of the sailors union of the Pacific Coast called some of the officials in Washington "phonies," and then added: "We're not playing politics, we're counting our economic strength."

It should be obvious to any well informed person that the Government is learning that it is losing its ability to prevent strikes. The post 1933 labor policies seem to have taken wage determination out of the hands of both private enterprise and the Government.

The Government was unable to say "no" in the coal strike; and it certainly was not able to say "no" in the seamen's strike, because before the force of the unions the Governmental gates of brass burst.

When employers on paid time ask employees to listen to what unions may consider anti-union talk, the National Labor Relations Board says that they are committing unfair labor practices. In other words employers' right of speech is curbed.

Unions are essential and can serve a useful purpose, but some of their methods and rules take some freedom from their members, for they are told how much and what they are permitted to do for employers.

For years the unions have used the productivity theory as one of their guides in wage determination. And yet in spite of the decline of productivity per employee and per hour since last spring, unions have shown no inclination to have their wages reduced; instead, they have demanded more and have received it. And to that extent the unions have created inflation.

The theory of left wingers that wage increases can be squeezed out of profits is unsound. Where there are no profits, or wages for that matter, initiative is destroyed, improved production techniques are slowed up, and capital shys from the assumption of risk in such ventures. Everyone who is alert knows that this left wing theory aims to bring about a redistribution of wealth.

This year, since last May, there has been a drop of \$13,500,000,000 in New York Stock Exchange security values. This is due to decreased productivity of workers, increased wages, strikes, shrinking profits, and a shying away of capital from industry. Even workers are withdrawing their investments from companies for whom they work because of the serious effects which labor-management disputes are having upon their investments.

Profits should be high enough to bring risk capital out of hiding for the purpose of putting it to good use; and wages should be high enough to attract labor. But this will never be settled by the bureaucrats whose heads are in the clouds. It must be settled by the established and well-known and well-understood principle of supply and demand.

The politicians are granting wage increases on the basis of it being the easiest way out of the situation and as a means of capturing votes to retain them in office, irrespective of the effects of their actions on the long run economic welfare of the country.

Many people blame the unions as being solely responsible for the present wave of instability. In doing so they forget that it was the politicians, with their 1933 post labor policies which set the chaotic forces into motion. They seem to have forgotten that the persons they elected to public office have confirmed the appointment of some men, said to be saints, who wear the buttons of the CIO, of the hammer and the sickle, and of the America Lasters.

The people should realize that they are to blame for the conditions of today. They willingly entrusted the government of the United States in the hands of politicians who are encouraging government paternalism—a form of government which will destroy initiative, resourcefulness, private enterprise, personal freedom and other elements which made the United States a great nation.

Because of the increasing seriousness of the labor question some feel that the next Congress may pass such drastic legislation as compulsory arbitration in which the Government will fix wages, and eventually establish a system of profit fixing and permanent price control; government operation and seizure; the making of the anti-trust laws applicable to the labor unions; or some form of state socialism.

To prevent this, metal and organic finishers and other citizens, if they do not wish to sell their freedom for doubtful security, must bestir themselves and help elect men who will not choke worthy impulses, who will not parch out the ability to see the difference between right and wrong, who will not dry up the individual's conscience of fair and honest productivity, who will not stifle wage earners from receiving a just compensation and who will not destroy private enterprise.

America is calling its citizenry to elect men who place the welfare of the United States above party politics and pressure groups. It is calling to elect men who create the kind of faith which overcomes imaginary fears, which casts out doubts, and which gives everyone a feeling of assurance and pride in being an American.

1,200 Degree Centigrade Thermometer Described in Report

A German developed gallium thermometer, with direct temperature readings up to 1,200 degrees centigrade, is described in 12 page Report PB-25550 which may be bought for one dollar from the Office of Technical Services of the Department of Commerce.

CPA in the Process of Liquidation

Chairman John D. Small is beginning to liquidate the Civilian Production Administration by transferring between now and the first of the year the functions of the tin and other metal divisions to other Government agencies.

Chemical Production in July 1946

According to the Bureau of the Census of the Department of Commerce there was produced in the United States during the month of July 1946 a total of 65,048 short tons of synthetic anhydrous ammonia; 62,658 short tons of ammonium nitrate; 16,685,000 pounds of ammonium sulfate; 27,960 short tons of hydrochloric acid; 3,729,000 pounds of hydrofluoric acid; 57,066 short tons of nitric acid; 123,500 short tons of phosphoric acid; 685,000 short tons of soda ash; 195,800 short tons of caustic soda; 19,000 short tons of sodium phosphate; 39,152 short tons of sodium silicate; 10,675 anhydrous refined sodium sulfate; 12,724 short tons of Glauber's

salt; 42,945 short tons of Salt Cake; and 1,932,500 short tons of sulfuric acid.

Small Electric Motor Shipments Increasing

The Civilian Production Administration reports that during August 1946 there were shipped 1,700,000 fractional horsepower alternating current motors as compared with 1,500,000 in July 1946.

Increased Production in Copper, Lead and Zinc Held Essential

T. E. Velfort, Manager of the Copper & Brass Research Association recently sent a telegram to Price Administrator Paul A. Porter, National Housing Agency Administrator Wilson W. Wyatt, War Mobilization and Reconversion Director John R. Steelman, and CPA Administrator John D. Small in which he stated that the production in basic industries will fall greatly unless there is an immediate increase in copper, lead and zinc stockpiles.

Caustic Soda Prices Advanced Five per Cent

The Office of Price Administration issued Amendment 23 to Supplementary Regulation 14F on September 12, 1946 for the purpose of increasing the price ceilings on chlorine, caustic soda and soda ash by 5 per cent.

New Advances in Lead Prices Foreseen by Porter

The Office of Price Administration has announced that no increase in current ceiling prices of lead or lead scrap, which were returned to June 30, 1946 levels, is planned in the foreseeable future. Substantial price increases for primary and secondary lead and lead scrap were granted by OPA on June 3, 1946. These increases, coupled with the subsidies paid on lead, the OPA pointed out, comply with the requirements of the law. "Since the premium price plan takes care of the mining of lead, and since the Reconstruction Finance Corporation is buying obtainable foreign lead and reselling it here at the domestic ceiling price," declared OPA Administrator Paul Porter, "there is no sound reason for further increase in lead ceiling prices."

Lead Price Increases Opposed

Reconversion Director John Steelman is opposed to an increase in the price of lead. He believes that "more enforcement" against lead hoarders is the solution to a more equitable solution to the dwindling supply of lead.

Silver Resellers Premium Increased

The Office of Price Administration announced on August 23, 1946 that premiums for distributors and resellers of silver were raised to restore their average percentage mark-ups of March 31, 1946. The new quantity differential premiums for resellers of silver are: 0.375 cents in lots of 100,000 ounces to 199,999 ounces; 0.50 cents in lots of 25,000 ounces up to 100,000 ounces; 0.625 cents in lots of 10,000 ounces up to 25,000 ounces; 1.00 cents in lots from 5,000 ounces up to 10,000 ounces; 1.5 cents in lots from 2,000 ounces up to 5,000 ounces; and 2.5 cents in lots under 2,000 ounces. This increase was provided for in Amendment No. 3 to revised Maximum Price Regulation 198, dated August 23, 1946.

Silver Using Wire Prices Increased

As a result of the issuance of Amendment 16 to Maximum Price Regulation 82 on August 23, 1946 by the Office of Price Administration, manufacturers who use silver in wire and cable are permitted to raise their ceiling prices for their products to the same amounts as the cost of silver has increased.

New Lead Prices

The dealer premiums for resellers of primary lead and secondary lead were raised to restore their average percentage mark-ups in effect March 31, 1946, according to Amendment No. 9 to Revised Price Schedule No. 69, and Amendment No. 3 to Maximum Price Regulation No. 70, issued on August 23, 1946. In other words the new premium differentials for resellers of either primary lead or secondary lead per pound, f.o.b. point of shipment are: 85 cents in lots of 20,000 pounds and less than a carload; 95 cents in lots of 10,000 pounds and less than 20,000 pounds; \$1.30 in lots of 8,000 pounds and less than 10,000 pounds; and \$1.90 in lots of less than 2,000 pounds.

Copper Price Advanced

Amendment No. 8 to Revised Price Schedule No. 15 issued by the Office of Price Administration on August 24, 1946 provides that copper resellers may raise their price one-fourth cent per pound in each quantity sales bracket.

A Number of Chemicals Suspended From Price Control

The Office of Price Administration has suspended price control on a number of chemical products on August 21, 1946. Some of these are cyanides of alkalis and heavy metals, and mixtures containing more than 25 per cent of these chemicals except silver cyanides. The compounds include copper, lead, potassium, sodium and zinc cyanide. Beeswax compositions containing 50 per cent or more of such wax, cleaning fluids based on sodium alkyl benzene sulfonate, and colloidal graphite were also suspended from price control.

Copper Production Increasing Steadily

The Copper Institute reports that during the month of August 1946 the production of crude copper totaled 64,200 short tons as compared with 56,906 short tons in July, 1946 and with 32,785 short tons in June 1946. Refined copper production has increased steadily from 23,870 short tons in June 1946 to 59,591 short tons in August 1946.

Platinum Prices Are High

The Civilian Production Administration is sticking to its policy not to release any platinum except to relieve "critical civilian shortages." Because of the shortage of this metal it is reported that current market quotations have ranged from \$90 to \$100 an ounce. Some believe these high prices might bring Russian supplies of platinum into the United States.

Tinplate Order Eased

The tinplate situation was eased when the Civilian Production Administration amended Direction 9 to M-21 for the purpose of freeing an additional 15 per cent of tin mill production which was previously channeled to the manufacture of cans and closures.

Zinc Production During Past Four Months

The American Zinc Institute reports that the August 1946 production of zinc amounted to 59,752 tons as compared with 59,014 tons in July 1946, with 58,812 tons in June 1946, and with 62,416 tons in May 1946.

Lead Restrictions Extended

Further restrictions governing the sale of lead by primary refiners because of the current shortage of this metal was provided for by the issuance of an amendment to conservation order (M-38) by the Civilian Production Administration on August 30, 1946. The amendment provides that refiners producing soft pig lead must now obtain an authorization from CPA to dispose of any lead (not subject to CPA's 25 per cent set-aside) which has not been sold by the 20th of the month.

Lead Situation

It is the belief of Frank H. Hayes, Director of the Metals and Minerals Division of the Civilian Production Administration that the current small imports of lead are not caused by the domestic price ceiling of 8 1/4 cents a pound because the Reconstruction Finance Corporation pays whatever price is necessary to get the lead and sells it at the domestic ceiling price. He is also of the opinion that domestic lead production is hampered largely by the lack of development work in the mines. Then too, he pointed out that mines are having difficulty in getting efficient workers. Mr. Hayes revealed that the current domestic lead demand is in excess of 1,000,000 tons a year whereas the supply is about 750,000 tons.

Brass and Bronze Ingot Prices Advance

To cover possible losses in melting scrap resulting from increased prices after June 3, 1946 the Office of Price Administration issued on August 27, 1946 Amendment 6 to Maximum Price Regulation 202 which grants brass and bronze ingot producers to advance their prices to absorb those losses.

Patents

Surface Roughness Measure

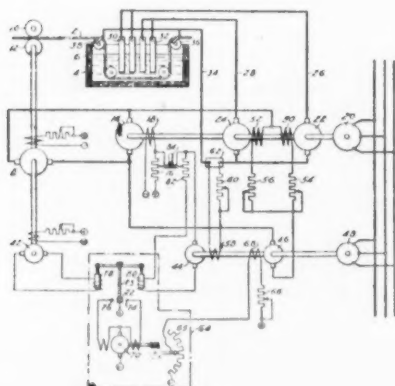
U. S. Pat. 2,405,133. J. Brown, assignor to the Brush Development Co., August 6, 1946. The method of investigating an irregular surface through utilization of an electrical pick-up device of the type including carrier means on which are mounted a movable tracer point and means operable by said point for generating a fluctuating electrical signal related to excursions of said point with respect to the carrier means that comprises bringing the point into contact with the surface, causing relative movement at a constant known rate between the carrier means and the surface transversely of the direction in which the tracer point is movable and along a path of predetermined length thereby producing a fluctuating electrical signal, dividing said fluctuating electrical signal into a first fluctuating electrical signal representative of the surface peaks and a second fluctuating electrical signal representative of the scratches, and deriving from said first and second electrical signals further electrical signals proportional to the squares of the instantaneous values thereof, integrating said derived signals and measuring the integrated signals to provide an indication of the total roughness of the peaks, or of the scratches or of both.

Mineral Oil Composition

U. S. Pat. 2,403,928. M. P. Kleinholz, assignor to Sinclair Refining Co., July 16, 1946. An improved mineral oil composition which comprises a petroleum lubricating oil fraction with which there has been compounded a proportion, effective to retard rusting, of a semi-lactide of the alpha hydroxy aliphatic acid in which the aliphatic radical contains from 10 to 18 carbon atoms.

Electrolytic Process Control

U. S. Pat. 2,404,948. C. P. Croco, assignor to Westinghouse Electric Corp., July 30, 1946. In a control system for an electrolytic process, an electric motor for causing a length of material to travel through the electrolytic process, a variable voltage generator for supplying power to the motor, means for varying the current in the elec-



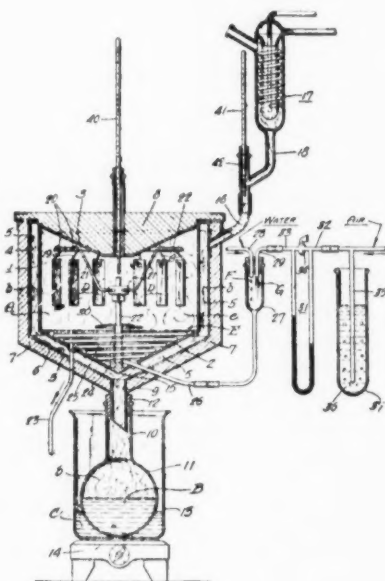
trolytic process in accordance with the voltage applied to the electric motor by said generator, and means for varying the current flow in the process in response to variations in the ratio between the speed of travel of the length of material through the process and the density of the current in the process.

Electrolyte Purifier

U. S. Pat. 2,405,302. G. and L. Hendrickson, assignors to Hudson Bay Mining and Smelting Co., Ltd. (Canada), August 6, 1946. In the purification of zinc electrolytes by means of metallic precipitants, and step of contacting the electrolyte with zinc dust coated with copper and indium as the precipitant.

Corrosion Testing Apparatus

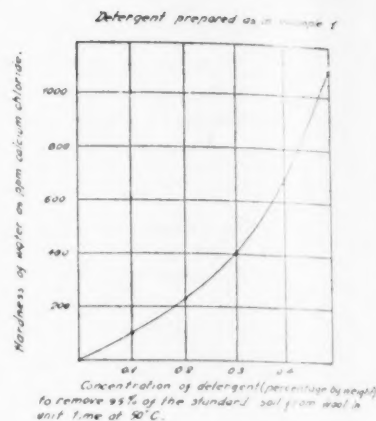
U. S. Pat. 2,405,532. F. Todd, assignor to Quaker Chemical Products Corp., August 6, 1946. A corrosion testing apparatus, comprising a closed walled test chamber, means for freely suspending test specimens



in said chamber, means in the form of a shell spaced from and completely surrounding a major portion of the exterior of said walled chamber and adapted to retain a vaporized heating medium in contact with said major portion of said chamber, an insulated removable cover enclosing the remaining portion of said chamber, means for supplying said medium to the space between said walled chamber and said shell for heating the walls of said chamber uniformly to a predetermined temperature, and means for supplying a corrosion-producing medium to the interior of said chamber for contact with and complete external envelopment of the test specimens arranged therein.

Saponaceous Detergent

U. S. Pat. 2,404,298. H. Kroll and M. Weisberg, assignors to Alrose Chemical Co., July 16, 1946. A detergent having improved hard water characteristics comprising a water-soluble organic amine, an amide of an alkylol amine and a higher molecular weight carboxy acid, and a water-soluble



soap, in the ranges 5-20%, 20-40% and 40-80% respectively, said percentages being based on the amount of these said three components, which detergent has the form of a bar or cake with a smooth uniform appearance and the smooth feel of bar soap and which is produced by heating the aforesaid components at substantially 125°-160° C. for a period of substantially 45-15 minutes.

Sanding Machine

U. S. Pat. 2,405,328. J. Robinson, Jr., assignor to Marsh Wall Products, Inc., August 6, 1946. A surface finishing machine including a rotating drum, a sheet of flexible surface finishing material located around said drum, a winding roll and an unwinding roll engaging opposite end portions of said sheet of surface finishing material, means for moving work through the machine in contact with the surface finishing material and means controlled by the movement of the work for operating the winding roll and unwinding roll for moving the sheet of surface finishing material circumferentially around the drum.

Detergent Composition

U. S. Pat. 2,404,289. W. B. Hicks and D. J. Saunders assignors to The Solvay Process Co., July 16, 1946. A detergent composition comprising (by weight) 40 to 50 parts sodium carbonate, 25 to 33 parts tetrasodium pyrophosphate, 2 to 7 parts trisodium phosphate, 2 to 7 parts sodium metasilicate, and 1 to 3 parts of a water-soluble, solid organic sulfonate detergent.

Abrasive Belt

U. S. Pat. 2,404,207. A. L. Ball, assignor, by mesne assignments, to United Cotton Products Co., July 16, 1946. The method of making a continuous endless and jointless felted fibrous web of homogeneous non-lamellar cross-section which comprises removing a thin continuous membrane of fibrous material from a carder, aerodynamically agitating said membrane to disturb and up-end the ends of the individual fibers from their normally parallel position without rupture of the membrane, feeding said membrane upon a moving endless support, retaining the initially deposited membrane upon said support while repeatedly passing said endless support with the initially deposited membrane beneath the carder to receive additional superimposed membranous layers

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while the ends of the individual fibers of the deposited membrane on the moving support are up-ended for interlocking with the fibers of that portion of the membrane being deposited to such an extent that the fibers of adjacent membranous layers interengage and interlock sufficiently to produce a homogeneous non-lamellar structure, continuing the deposition of said continuous membrane under said conditions for interlocking and without interruption of the flow of membrane from the carder until a jointless and endless web of the desired thickness is formed on the endless support, breaking the flow of membrane from the carder and removing the resulting fibrous web from said support.

Polishing Cloth

U. S. Pat. 2,403,821. J. D. Morgan and R. E. Lowe, assignors to Cities Service Oil Co., July 9, 1946. A cloth for cleaning and polishing metal surfaces comprising a soft and absorbent sheet impregnated with a polishing mixture consisting of from 5 to 10 per cent by weight of oleic acid, from 1 to 4 per cent by weight of triethanolamine, from 20 to 60 per cent by weight of magnesium oxide (light), from 15 to 45 per cent by weight of precipitated calcium carbonate, and from 10 to 30 per cent of infusorial earth.

Bushing for Polishing Wheels

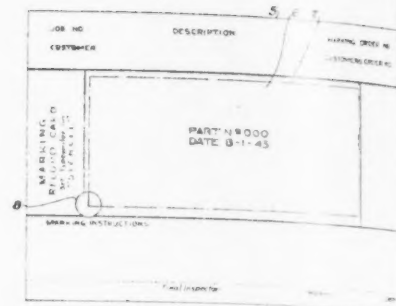
U. S. Pat. 2,403,813. James J. Mandercheid, July 9, 1946. A bushing adapted to be pressed into and automatically locked in a centrally disposed opening in a preformed polishing wheel, consisting of a member formed of relatively thin gauge metal and provided with a peripheral flange and a hub portion, the latter adapted to be pressed into the opening and anchoring projections formed from the material of the hub and adapted to embed in the material of the wheel as the bushing is pressed into the opening.

Refining of Nonferrous Metals

U. S. Pat. 2,403,586. L. S. Deitz, Jr., assignor to Nassau Smelting & Refining Co., Inc., July 9, 1946. The process of refining metal consisting principally of tin and lead and containing a minor quantity of metal of the group consisting of copper and antimony, which comprises incorporating such a quantity of aluminum in said metal as to constitute from about 0.2% to about 0.5% of the resulting alloy, and electrolyzing anodes of the resulting aluminum-bearing alloy in an electrolyte whose principal electrolytic agent is an aromatic sulphonic acid to cathodically deposit a substantially pure tin-lead alloy, the aluminum being present in the anodes in an amount sufficient to prevent the occurrence in the anode slimes of a material quantity of tin which would otherwise be precipitated in said slimes.

Electrolytic Stencil

U. S. Pat. 2,405,508. A. R. Lindsay, August 6, 1946. A stencil for use in electro-etching metal surfaces comprising a thin



carrier web coated with an acid resistant dielectric film, a card of paper or the like to which said web is detachably secured along one edge, a sheet of carbon paper or the like interposed between said card and web also detachably secured to said card along one edge, said web being composed of a felted material having long fibres and having a nitrocellulose covering thereon and an electrolyte resistant coating covering said nitrocellulose coating.

Deterging Compositions

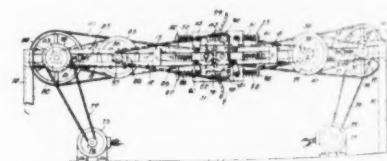
U. S. Pat. 2,404,297. H. Kroll, assignor to Alrose Chemical Co., July 16, 1946. A composition of matter having deterging and wetting properties composed of a mixture of a neutral higher fatty acid amide of the alkylol amines, a water-soluble soap containing from 10 to 18 carbon atoms inclusive, in which the cation is a member of the group composed of the alkali metals, ammonium and substituted ammonium bases, and a water-soluble organic nitrogenous base, said mixture having been heat treated for substantially 15-45 minutes in the range substantially 160-125° C.

Corrosion Prevention

U. S. Pat. 2,403,293. J. J. Miskel, assignor to National Oil Prod. Co., July 2, 1946. An anticorrosion coating composition for metals comprising chiefly mineral oil and a fatty oil with a minor proportion, in an amount to function as an anticorrosive agent, of a fatty amido-amine containing fatty chains of from 10-22 carbon atoms.

Abrading Machine

U. S. Pat. 2,404,917. E. C. Murdock, July 30, 1946. An abrading machine comprising a pair of endless abrasive belts, a pair of rotatable means for supporting the belts for rotation, means for urging the proximate ends of the belts towards each other so that a workpiece can be passed therebetween to finish the same, a pair of resiliently mounted feed rollers disposed on each side of the rotatable means on which the proximate ends of the abrasive belts are mounted for



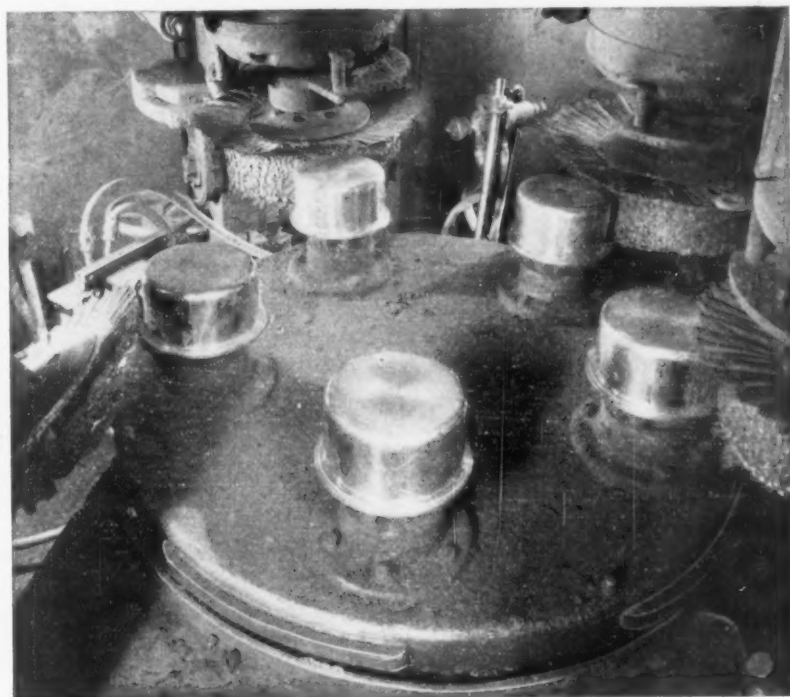
feeding a workpiece between the proximate ends of the abrasive belts and means for driving the feed rollers so that their proximate surfaces move in the same direction and for also driving the abrasive belts so that their proximate ends rotate in the same direction but in a direction opposite to the direction of rotation of the proximate surfaces of the feed rollers.

Plating Rack

U. S. Pat. 2,407,145. C. T. Elwin, assignor to Secovill Mfg. Co., Sept. 3, 1946. The method of racking small metallic articles of like uniform character upon a portable support member for electrolytic treatment of the character of electroplating or anodizing which comprises the use of portable imperforated flat electrical conductor plate of relatively thin material to one side of which is applied an adhesive material immune to the electrolyte and of a frangible character when in a dry state, applying the articles in a prearranged manner and a separated state to the adhesive side of said plate and setting a relatively small portion of each article into said adhesive material while in a tacky state, applying sufficient axial pressure upon each of said prearranged articles to squeeze the adhesive material from between the adjacent surfaces of said articles and plate and establish electrical contact there between, said displaced adhesive material forming an anchor fillet about each of the articles adjacent the point of contact, maintaining the articles in a fixed manner relative to the plate until said adhesive material has set, subjecting said articles to an electrolytic treatment of the character mentioned above and thereafter breaking them away from said support as individual units.

Abrasive Article

U. S. Pat. 2,406,385. S. S. Kistler, assignor to Norton Co., Aug. 27, 1946. The steps in the method of making an abrasive article which comprise improving the workability of an unvulcanized butadiene polymer by treating it during working with a halogen-bearing plasticizing agent in which the halide is selected from the group consisting of chlorine, bromine and iodine and which is substantially non-reactive with the polymer but capable of softening and making the polymer plastic under mechanical working thereof for the reception therein of abrasive grain; distributing into and throughout the plasticized butadiene polymer a vulcanizing agent, abrasive grain, and a resin polymer having amino groups therein and with which resin polymer the halogen-bearing plasticizing agent is capable of reaction at elevated temperatures and at the amino groups thereof to harden it but is incapable of substantial reaction at working temperatures of the resultant mix; shaping the mix; and under heat treatment of the shaped mix, reacting the halogen-bearing agent at the amino groups of the resin polymer to harden the resin and vulcanizing the butadiene polymer by reacting with the vulcanizing agent.



FOUR WAYS OF SAVING WHEN YOU USE THE SPRAY METHOD OF BUFFING WITH **BUFFING NU-SPRA-GLU**

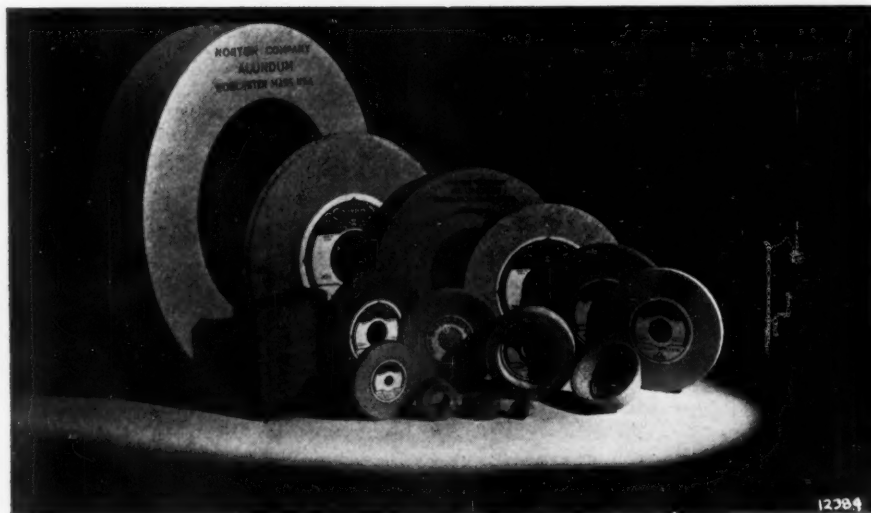


The deep drawn aluminum cups above are buffed to a mirror finish from top to flange by BUFFING NU-SPRA-GLU, a liquid composition that is sprayed to the buffs while they are revolving. Standard spray equipment is used. There is little waste, as practically all the material is sprayed directly on the wheels, and stays put. BUFFING NU-SPRA-GLU is made in various grades to suit various metals. There is a TRIPOLI and a STAINLESS STEEL, LIME FINISH for NICKEL BUFFING, ROUGE for GOLD BUFFING, a BURRING COMPOUND and LIQUID GREASE. The spray method of applying compound to the polishing wheel was a development of the J. J. Siefen Co. in 1945, and patent has been applied for on method.

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NEW EQUIPMENT AND SUPPLIES

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Aluminum Oxide Abrasive

A new aluminum oxide product known as 32 Alundum abrasive is announced by Norton Co., Dept. MF, Worcester, Mass. The grit is made by a new electric furnace process which produces grains of an improved shape and structure, each grain being a complete, single crystal. It is claimed that tests conducted in hundreds of plants have shown that grinding wheels made of this material have a definitely faster and cooler cutting action, have longer life and require fewer dressings.

The grains of the new abrasive form in the electric furnace as single, individual crystals which do not require any crushing to size. Inasmuch as the crystals form individually they assume a chunky, nubby shape. The many plane surfaces form both exterior and reentrant dihedral angles, the latter making definite rake angles which increase the cutting efficiency of the grains, according to the manufacturer.

The new and special electric furnace process by which the abrasive is made was invited and is patented by Norton. Essentially it consists of fusing high purity aluminous ores in the electric furnace in such a manner that individual crystals of commercial grain sizes are formed in a fluid matrix. The high-purity, chemically stable crystals are then separated from the matrix by a complicated, continuous chemical process. Without crushing, the naturally formed crystals are screened into standard grain sizes.

Gas-Measuring Instrument

The Oxygen Indicator Type C, for measuring the oxygen content of gaseous mixtures in chemical, metallurgical, petroleum, and allied industries, for combustion and process

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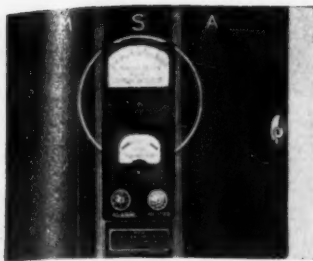
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control, in gas transmission and distribution, for improving the safety of utility operations and controlling pipe line corrosion, is the newest of a line of precision gas-detecting and measuring instruments made by Mine Safety Appliances Co., Pittsburgh, Pa.

The most important single element is said to be its electrolytic detector cell. This is made up of a plastic container with a hollow carbon tube and metallic plate serving as electrodes in approximately an ounce of liquid electrolyte. Polarization in the cell causes hydrogen to be deposited on the carbon pole. When a gas sample containing oxygen is passed through the hollow carbon electrode, diffusion through the porous carbon causes the oxygen to combine with the "electrolytic hydrogen" reducing the internal resistance of the cell and causing its current and voltage output to be increased. A direct reading meter, having a linear scale indicates the percentage of oxygen in the sample.

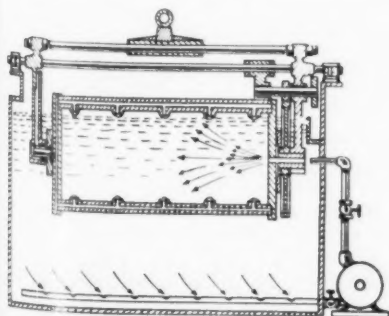
The indicator is available in any of the following standard, full scale ranges—0 to 0.5%, 0 to 5%, 0 to 10%, and 0 to 25%. The integral concentration meter can be read directly to 2% of full scale range. An adjustable high point contacting device, provided in each unit, can be used for automatic activation of warning signals or control circuits whenever oxygen concentration exceeds a predetermined limit.

Bulletin No. DW-3 which illustrates and completely describes the new equipment may be had by writing to Mine Safety Appliances Co., Dept MF, Braddock, Thomas, and Meade Sts., Pittsburgh 8, Pa.

Plating Barrel with Pump

The Hanson-Van Winkle-Munning Co., Dept MF, Matawan, New Jersey, announces the development of the new Mercil Plating Apparatus with pumping equipment.

Tests have shown that where the plating apparatus is furnished with pumping equipment, plating time is reduced, according to the manufacturer. On one such unit where cadmium plating is being done, the plating time has been cut from 20% to 25%, it is claimed. In working with cyanide solutions,



6 SOLUTIONS TO YOUR STOP-OFF PROBLEMS

with UNICHROME Stop-Off Lacquers and Compounds

Whatever the piece to be plated, simple or complex—whatever the plating and cleaning cycles, moderate or severe—you'll find a Unichrome stop-off that will do the job *right*. Unichrome stop-offs minimize rejects . . . save valuable time and effort.

These six stop-off materials, each formulated to provide a different combination of characteristics, enable you to select the lacquer or compound which will give the best over-all results for any problem you encounter. Write today for prices and data.

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These tough, synthetic materials are easily applied and, in general, are used for all simple shapes where areas can be conveniently stopp'd off by brushing. Available in three formulations, No. 322, 323, and 324, to provide different combinations of characteristics, they all withstand hot cleaners and acid dips, and will not contaminate plating baths.

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These quick-hardening, wax-like stop-offs are applied by dipping the part in the melted compound, quickly covering even the most complicated shapes and sharp edges with a tough, durable coating. The three separate compounds, No. 311, 314, and 315, provide resistance to solutions of various temperatures, from 160°F for No. 314, to 245°F for No. 311.

PROCESSES AND MATERIALS FOR SURFACES THAT SURVIVE

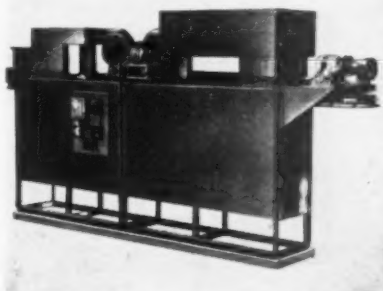
Chromium Plating • Porous Chromium • Unichrome® Copper • Unichrome Lacquers • Uclon® Protective Coatings • Unichrome Stop-Off Lacquers and Compounds • Unichrome Dips • Unichrome Rack Coatings • Anozinc® Compounds • Unichrome Strip

*Trade Mark Reg. U. S. Pat. Off.

Cold and Hot Air Dryer

A machine designed to dry loaded racks continuously before or after plating, or after any other type of water-solution dip, has been introduced by the Optimus Equipment Co., 129 Church Street, Matawan, N. J., manufacturers of metal washing and drying equipment.

The machine is said to be continuous in





Faster drying of metal parts on racks is accomplished with the use of the new OPTIMUS Continuous Type Drying Machine. Ideal for handling loaded racks continuously after plating, or after any water solution dip. Drying time runs 4 to 6 minutes.

This new OPTIMUS Dryer is used largely as a cold air and hot air dryer. Cold air system includes a blower and a series of nozzles.

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"Cleaning Metal Parts before
and after finishing"



**DEPENDABLE
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for every metal
cleaning equipment
operation.

Hot air system includes an air heater, re-circulating blower, a damper to adjust the mixture of atmospheric and re-circulating air, and necessary nozzles.

It can be used as a single stage dryer, or it can handle a number of successive operations, alkaline, acid, or neutral. Enclosed design of machine permits efficient ventilation through exhaust blower connection when desired. Can be heated by steam, gas or electricity.

An OPTIMUS Plan for the mechanized handling of your metal parts through washing, rinsing and drying, can help you save labor, reduce rejects and increase your production.

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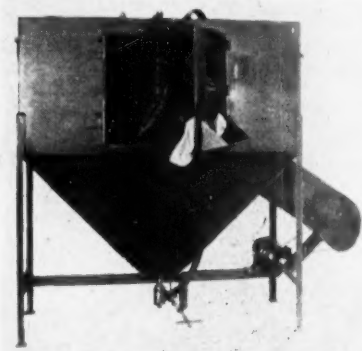
its operation, and works almost completely closed and can be connected to an exhaust blower, so that all fumes can be drawn off. Any heating system, steam, gas, or electricity, can be employed and drying time is stated to be from 4 to 6 minutes.

The Continuous Cold and Hot Air Dryer can be used as a single-stage dryer or in connection with a number of successive operations, alkaline, acid, or neutral. The manufacturer states that it is most efficient as a stainless dryer, although other uses are practical.

Sandblasting Equipment

A new feature of the machine illustrated is the combination door and armholes with cuffs, which is readily swung open for easier ingress or egress of articles to be sandblasted, as well as the removal and replacement of the basket.

The machine is a self-feeding sandblast which has a magazine from which the sand is fed through the nozzle and on the work, after which it is continually returned by gravity to the sand magazine to be refed to the nozzle.



The sandblast shown is one equipped with a rotating motor-driven tumbling basket which handles small articles, such as nuts, bolts or buttons. It tumbles them over and over as it rotates while the nozzle continuously sprays the lot with sand, producing cleaning action on all sides.

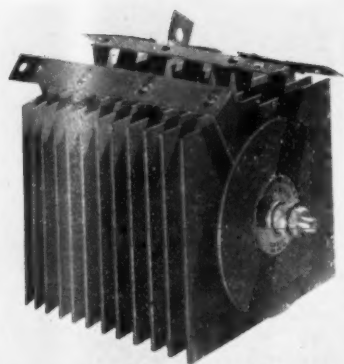
When sandblasting is required on larger pieces of work, the basket itself may be instantly detached and removed from the cabinet, which makes the entire interior space available. The operator then holds the larger pieces under the nozzle, turning each piece until it is entirely cleaned.

Very rapid work is accomplished in cleaning prior to finishing; rust, scale, or carbon deposits are quickly eliminated. By cleaning burnt sand deposits by sandblast, quicker machine operations result.

Full information will be furnished by the makers, Leiman Bros., Inc., Dept. MF, 125 Christie St., Newark 5, N. J.

Selenium Rectifier Plates

Developed specifically for high current capacity, and especially applicable for electroplating and battery charging, but not limited to this size, are the new 5" x 5 1/4" selenium rectifier plates built on aluminum.



now being manufactured by the Seletron Division, Dept MF, of the Radio Receptor Co., 251 W. 19th St., New York 11, N. Y. Featuring long life and minimum weight with maximum heat dissipating value, these stacks when arranged in suitable combinations of series or parallel plates are claimed to be extremely compact and to deliver continuous economical service.

Surface Roughness Recorder

For those who need a written record of the surface roughness measurement of a part, the new Profilometer Reading Recorder has recently been developed. Operating as an attachment to the Profilometer made by Physicists Research Co., the Reading Recorder provides a continuous chart record of the average roughness of the surface being measured.

The charts, which are read in microinches like the Profilometer microinch meter, are useful in obtaining more detailed information on surface roughness, such as the location of rougher or smoother areas, and in supplying customers with records of the surface finish on parts delivered to them.

The Recorder attaches at the meter jack provided on all Profilometers. No adaptations of existing Profilometer equipment are necessary. For a leaflet describing the Profilometer Reading Recorder, write Physicists Research Co., Dept. MF, Ann Arbor, Mich.

Nylon Faced Hammer

A new "soft" hammer with faces of nylon with all the features of all soft hammers and none of the disadvantages of any one is the claim of the manufacturer, the Danielson Mfg. Co., Dept. MF, Danielson, Conn.

It is claimed that nylon has been proved by exhaustive tests to outperform all other "soft" hammer materials. It is said that nylon wears longer, handles well, does not chip or mushroom, has no rebound, is resistant to fire, chemicals and oils, and does not heat up or change in shape under continued use.



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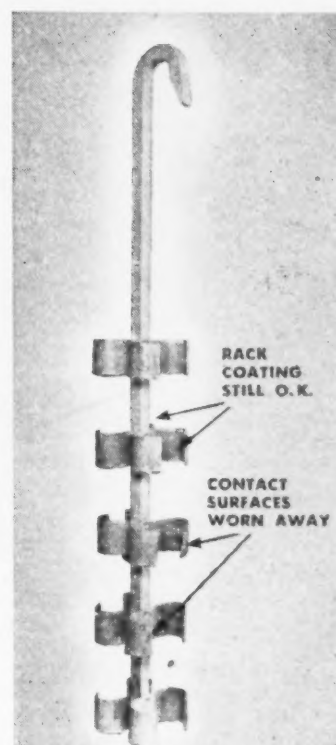
The extra service formulated into this Unichrome rack coating is the result of years of intensive research and development in the highly specialized field of synthetic resins. Write today for prices and detailed data.

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SURFACES
WORN AWAY

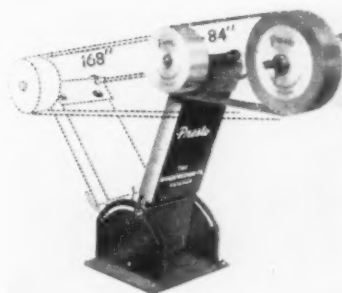
UNICHROME RACK COATING 203

... an air-drying coating with excellent adherence for all plating cycles such as chromium, nickel, copper, zinc and cadmium.

PROCESSES AND MATERIALS FOR SURFACES THAT SURVIVE

Chromium Plating • Porous Chromium • Unichrome® Copper • Unichrome Lacquers • Uclon® Protective Coatings • Unichrome Stop-Off Lacquers and Compounds • Unichrome Dips • Unichrome Rack Coatings • Anozinc® Compounds • Unichrome Strip

*Trade Mark Reg. U. S. Pat. Off.



Back-Stand Idler

Quick change to any belt length is provided in a new Presto Back-Stand Idler recently announced by The Manderscheid Co., Dept. MF, 810 Fulton St., Chicago 7, Ill.

The idler can be adjusted for any belt length from 84" to 168" in 30 seconds or less, it is claimed. It is of all steel construction with double sealed ball bearings and leaf type springs afford the adjustable tension. Snubber action eliminates vibration and belts run smoothly while the aluminum pulley is perfectly balanced and is easily changed from right hand to left hand operation, according to the manufacturer.

Literature will be mailed upon request.



● Sure! A pig's snout lasts him a lifetime but—it doesn't have to take what plating rack insulation does.

● Hot alkali cleaners, strong acids and alkali solutions and the careless handling that electro plating racks and fixtures must withstand in decorative plating—Copper, Nickel, Chrome—would make short work of a pig's snout.

● But BUNATOL 785, built strictly to withstand all present day decorative plating difficulties, is not only far tougher than the proverbial pig's snout, but it's just as flexible.

● Write or wire for sample and complete information.

NELSON J. QUINN COMPANY, TOLEDO 7, OHIO

BUNATOL 785

Business Items

PENNSALT STAFF ADDITIONS

I. R. Mockrin, former research engineer with *Battelle Memorial Institute*, and *W. A. Blum*, recently with the *Tennessee Valley Authority*, have accepted appointments to its Research and Development Department. It is announced by *Pennsylvania Salt Manufacturing Co.* Other additions to the technical staff at *Pennsalt's* *Whitemarsh Research Laboratories* include: *W. A. Millsaps*, formerly with *Chemical Warfare Service*, *Edgewood Arsenal, Md.*; *A. J. Baldi*, recently graduated from the University of *Pennsylvania*; *Miss A. L. Nicholson*, former librarian, Development Department, *Naugatuck, Chemical Div., U. S. Rubber Co.*

Following their release from the armed services, *J. H. Koob*, *L. C. Dormuth*, *R. A.*

Sprout, *S. D. Loomis*, and *C. W. Hagerman*, members of the company's Research and Development staff, recently returned to their old positions.

AMERICAN CYANAMID ALTERS NAME

Announcement is made that the corporate name of *American Cyanamid & Chemical Corp.*, 30 Rockefeller Plaza, New York 20, N. Y., manufacturers of industrial chemicals, has been changed to *Industrial Chemical Division, American Cyanamid Co.*

A complete list of the products handled by the *Industrial Chemical Division* may be had by writing to the company at the above address.

WARD APPOINTED BY UDYLLITE

The *Udylite Corp.* has appointed *Howard J. Ward* district manager for the Michigan territory.

Mr. Ward has been with *Udylite* for the



Howard J. Ward

past ten years, and during the war spent most of his time in Washington with the Army and Navy Engineers on plating problems. During this time, he was given a citation from the Navy Department's Chief Maintenance Engineer, Bureau of Aeronautics, for meritorious service. Mr. Ward will replace *William H. Ross*, who recently resigned.

HERCULES NAMES BROWN

Thomas E. Brown has been appointed assistant superintendent of the *Bacchus, Utah*, plant of *Hercules Powder Co.*, *W. E. Chan*, director of operations of the company's Explosives Department announced today.

An employee of the company since April, 1939, Mr. Brown has been associated with the Explosives Department since September of that year when he went to the *Kenvil, N. J.*, plant as a chemist in the laboratory.

He transferred to the *Bacchus* plant in August, 1940, and remained there until February, 1942, when he moved to the *Hercules, Cal.*, plant in the same capacity of chemist. One month later, he was appointed assistant dynamite supervisor, and in July, 1944, was made dynamite supervisor. He has been at the *California* plant until his present reassignment to *Bacchus*.

Mr. Brown is a graduate of *Iowa State University* where he received a B.S. degree in chemical engineering.

U. S. RUBBER TO INCREASE PRODUCTION

United States Rubber Co. has announced that plans are being made to triple its production of high-speed grinding wheels used by steel mills, foundries and metal fabricating plants.

Increased production facilities will be established in a new plant in *Ft. Wayne, Ind.*, recently acquired from the government. *J. A. Fairfield*, manager of grinding wheel sales, said the company will increase the volume and variety of both rubber and synthetic resin bonded wheels.

A subsidiary of the company in 1865 developed the first synthetic bonded grinding wheel to be made in this country. The bonding agent was rubber and the grain natural emery. Previous to that time the only solid

abrasive wheel in existence was cut from natural sandstone. Then quickly followed the development of the vitrified and silicate wheels and much later the synthetic resin bonded wheel.

NEW TECHNICAL SECTION ANNOUNCED BY INTERNATIONAL NICKEL

The International Nickel Co., Inc. announces the opening of the Texas Technical Section of its Development and Research Division, which is located in the Bankers Mortgage Bldg., Houston, Texas. It will furnish to industry technical information and assistance relating to alloys containing nickel. The Section's activities will cover the States of Texas, Oklahoma, Louisiana, Mississippi and the southern half of Arkansas.

R. J. Rice, Metallurgical and Chemical Engineer, will be in charge. Mr. Rice was associated with the *Beaumont Iron Works Co.* from 1933 to 1938 where he was responsible for the operations of its metallurgical department, melting shop, heat treating department and specifications for steels and irons. Later he became associated with *Metal Goods Corp.* of Houston, Texas where he held the position of Foundry Engineer and Metallurgist. He directed his activities toward the use of nickel in iron and steel foundries and the industrial application of nickel containing alloys.

Mr. Rice was released from the Navy early this year with the rank of lieutenant-commander after having served since October 1942, and immediately joined the staff of The International Nickel Co. to establish the Texas Technical Section.

JOSEPH HAAS FORMS NEW COMPANY

Announcement of formation of the *Industrial Advisory Co.*, South Norwalk, Conn., is made by *Joseph Haas*. The new company enters the industrial consulting field with a staff equipped for complete coverage.

Mr. Haas has had considerable training in industry in and around New York. For several years prior to his entrance into executive positions, Mr. Haas was connected with the metal finishing industry as a fore-



Joseph Haas

VAPOR DEGREASING PLUS



Even though solvent vapor degreasing has been used successfully on thousands of applications it is not considered a "cure all" for all metal cleaning problems. A combination of Detrex processes is often the answer. Here is a case where a Triad Emulsion was used with vapor degreasing.

the Problem

The removal of residual solids remaining from drawing compounds after vapor degreasing was the problem. Hand wiping costs were running \$100 a day.

the Answer

A Detrex field representative recommended a pre-dip of Triad 93 and fuel oil at room temperature. The drawing compounds were completely wet out in this solution, then were removed in the degreaser.

THE RESULT

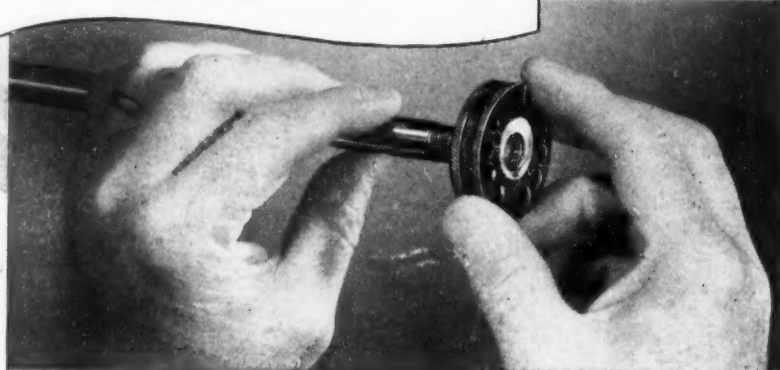
The work came out 100% clean—no smut, no dirt, no residue. Hand wiping costs were eliminated and production was speeded up.

Detrex field representatives can suggest cleaning processes to answer your individual problem. Consult one today.



Ingenious New Technical Methods

To Help You with Your
Reconversion Problems



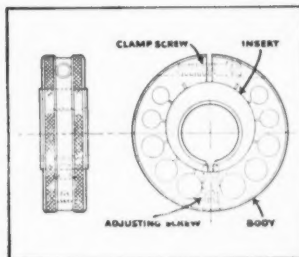
New Thread Ring Gage Starts Round Stays Round With Every Adjustment!

Employing a new principle of design, the Woodworth Thread Ring Gage closes in round within .0002 maximum after .005 adjustment. It offers greater accuracy and stability since size adjustment is controlled along thread helix angle. Threads are held securely in alignment after adjustment, due to unique adjustment means. Wear is distributed over full circumference for all resettings, thus increasing life of gage.

Positive adjustment makes it almost impossible to change setting with ordinary knocks. Positive identification by a green "go" gage and red "not go" gage saves operator time. Aluminum alloy outer body cuts weight in half, to reduce operator fatigue and increase sensitivity.

To also reduce fatigue on precision jobs, many plant owners make chewing gum available for workers. Tests show that the act of chewing aids in relieving tension, which is often the cause of fatigue. These tests further reveal that chewing Wrigley's Spearmint Gum, for instance, helps workers stay alert, thus increases their efficiency to do more accurate work.

You can get complete information from
N. A. Woodworth Company
1300 East Nine Mile Road, Detroit 20, Michigan



Woodworth Thread Ring Gage



AA-93

man plater. For the past 20 years, he has been associated with the *National Silver Co.*, Brooklyn, N. Y., as factory superintendent; *The Bassick Co.*, Bridgeport, Conn., as factory superintendent, and *Francis Keil & Sons, Inc.*, New York, N. Y., as factory manager. Mr. Haas is an industrial engineer, a member of the American Electroplaters' Society, the Electrochemical Society, Society of Professional Engineers, and the Society for the Advancement of Management.

The company is in the general manufacturing consulting field and is prepared to assist in all manufacturing operations, methods and processes.

ATKIN AND McLEOD JOIN DOW

Howard P. Atkin, after four years service

with the Army Air Corps recently became a member of the Cathodic Protection Sales staff of *The Dow Chemical Co.*, working in the Los Angeles, Calif., office. Mr. Atkin is a graduate in chemical engineering of the University of Southern California.

Ray H. McLeod, a graduate chemical engineer from Northwestern University, has also joined the Cathodic Protection Sales staff following his release from the Navy. Mr. McLeod is working in Dow's Chicago office.

BAYER JOINS SPECIAL CHEMICALS

Walter R. Bayer recently joined the staff of *Special Chemicals Corp.*, 30 Irving Pl., New York 3, N. Y., in charge of sales. The firm is in the plating and chemical engineering line and are manufacturing chemists.



Walter R. Bayer

Mr. Bayer was in the Electro-Chemical Dept. of *E. I. DuPont de Nemours and Co.*, for 21 years. Later he was with the *Empire Electroplating Supplies Corp.*, New York City.

WAGNER ELECTS ROSS

W. Ross has been recently elected vice-president of *Wagner Brothers*, 1249 Holden Ave., Detroit, Mich., plating equipment and material suppliers.

Mr. Ross will function as sales manager and participate as a member of the firm. He is well known in plating circles in the mid-western area.

DU PONT RETIRES ACKART

The Du Pont Co. announced the retirement of **Everett G. Ackart**, chief engineer, and the appointment of **Granville M. Read** to succeed him. Mr. Read has been assistant chief engineer of the company since 1943.

Mr. Ackart, who climaxed his career by supervising the design and construction of more than a billion dollars worth of war plants which Du Pont built and operated at the Government's request, has been with the company almost 40 years. He started with Du Pont in 1907 as a junior engineer assigned to power testing and power-cost checking.

Mr. Ackart, who reached 65, the Du Pont retirement age, this month, was born at Schaghticoke, Rensselaer County, New York. Both of his parents, John Baker and Mary F. Gunner Ackart, were school teachers. Upon graduation from Troy Academy, of Troy, N. Y., in 1898, Mr. Ackart entered Wesleyan University, Middletown, Conn., from which he received the degree of Ph.D. in 1902. He studied at Cornell University for three years, receiving a mechanical engineering degree in 1905.

Mr. Read is 52 years old and a native of Bedford County, Va. He studied at Virginia Polytechnic Institute and in France, joining the Du Pont Company as a ticket puncher when Du Pont was operating a smokeless powder plant at Hopewell, Va., in 1915.

Mr. Read is a director of the Remington Arms Company, Inc., affiliated with the Du Pont Company.

OGDEN AND McCARTHY NAMED BY MONSANTO

Dr. L. A. Pratt, General Sales Manager of Monsanto Chemical Company's Merrimac Division, today announced the appointment of F. Faxon Ogden as Manager of Special Products Sales Development and of J. J. McCarthy as Manager of Chemical Sales Development in charge of new products for the paper and leather industries.

Mr. Ogden was formerly manager of chemical sales development. In his new capacity he will specialize in the marketing of Santocel, a silica aerogel which Monsanto describes as the most efficient thermal insulant ever tested. Mr. McCarthy was formerly manager of textile sales development.

Entering Monsanto's service shortly after his graduation from Cornell University, Mr. Ogden served successively as research chemist, assistant in the technical service department, assistant branch manager of the New York sales office, and manager of chemical sales development. He spent two years in the U. S. Navy as administrative officer aboard the support carrier U.S.S. *Manila Bay*.

Mr. McCarthy, a graduate of Massachusetts State College, entered Monsanto's service in 1922, serving successively in the control laboratory, the sales department and the development department. He was a member of the 1924 American Olympic Ice Hockey Team, and was captain of the Boston Athletic Association Hockey Team, National Amateur Champions in 1922 and 1923.

ROOTS-CONNERSVILLE ELECTS VICE-PRESIDENT

Ralph R. Newquist has been elected vice president in charge of sales of Roots-Connorsville Blower Corp., Connorsville, Ind., one of the Dresser Industries.

CALGON APPOINTS NEW MEN

The Banox division of Calgon, Inc., which recently brought out a new rust-proofing material for steel has added two new men to its field sales staff.

According to C. T. Roland, in charge of research and applications of the new treatment, J. G. Ripstra will work out of the Detroit office, covering Detroit, Grand Rapids, Chicago, Milwaukee and other cities in that area. Richard J. Skillman, working out of the Philadelphia office, will cover the eastern seaboard.

Mr. Ripstra is a native of Grand Rapids and Kankakee, Ill. He was graduated from St. Viator's College, Bourbonnais, Ill., then from the University of Illinois with a B.Sc. in chemical engineering, and has had ten years' experience in paint manufacturing and metal treating.

Mr. Skillman is a native of Newark, N. J., son of a railroad maintenance engineer. He was graduated from Mercersburg Academy in 1930 and from Princeton in 1934. Leaving college, he promoted use of a special metal- and wood-coating material. He then was a sales engineer with the General Refractories Company. In 1944 he was commissioned in the Navy as lieutenant, emerging from service last March.



ONE ALWAYS STANDS OUT!

In the field of metal cleaners,
Wyandotte Porenac is an unequalled performer.

Prepared especially for the removal of drawing lubricants prior to pickling in porcelain enamel plants, Wyandotte Porenac emulsifies the toughest mineral oil compound with speed, economy and certainty.

The superior action of this balanced formulation eliminates the necessity for pre-cleaning, and thus greatly reduces over-all cleaning time. Its concentration requirements are low—its life in solution remarkably long.

Important, too, are the free rinsing qualities of Wyandotte Porenac, which prevent contamination of solutions in subsequent operations.

Wyandotte Porenac is of such versatility that it probably can be adapted to your specific problem, whether it be cleaning prior to porcelain enameling, barrel-plating, oxide finishing or other heavy-duty cleaning operations.

Your Wyandotte Representative will gladly tell you more about this and other Wyandotte Metal Cleaners. A call will bring him.



SERVICE REPRESENTATIVES IN 88 CITIES

WYANDOTTE CHEMICALS CORPORATION • J. B. Ford Division • Wyandotte, Michigan



Sandoz welcomes the opportunity to serve you on your anodized aluminum color requirements



SANDOZ CHEMICAL WORKS, Inc.

61-63 VAN DAM STREET, NEW YORK 13, N.Y.

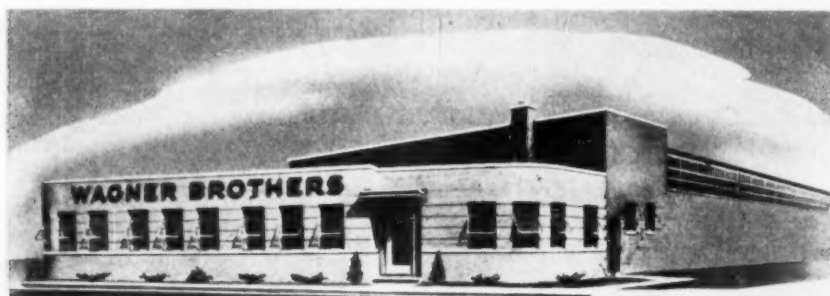
WAGNER OPENS NEW PLANT

Wagner Brothers, suppliers to the metal finishing industries, have announced the opening of their new plant and warehouse at 400 Midland Ave., Detroit, Mich. Besides increased space for their stock of buffing, polishing and plating materials and equipment, their new quarters will house a complete analytical laboratory and modern pilot

metal finishing set-up.

The firm offers these facilities for customers' use for solving their daily production problems as well as for the testing of new materials, methods and equipment.

This group was founded by Joe and Fred Wagner, sons of the late A. T. Wagner, in 1940, and have been operating in the Michigan industrial area ever since that time.



MOZER JOINS METAL FINISHING STAFF



Richard A. Mozer

Announcement is made of the recent appointment of Richard A. Mozer to the staff of *Metal Finishing* as Engineering Editor.

Mr. Mozer had undergraduate work in Electrical Engineering at Purdue and Indiana Universities and a B. Sc. degree in Chemical Engineering from Tri-State College of Engineering. For several years he was in the Design Engineering and Works Laboratory divisions of the General Electric Co., Fort Wayne Works. In charge of the Process Section of GE's Fort Wayne Works Laboratory for the major part of the war, Mr. Mozer was responsible for setting up and maintaining organic and inorganic finishing processes in the plant as one of his major duties.

During the latter part of the war, he became part-owner of the General Plating & Engineering Co., Fort Wayne, Ind., developing a consulting chemical engineering clientele in addition to metal finishing service in the plant. At war's end, Mr. Mozer joined the Hammarlund Mfg. Co., New York City, as Applied Finish Superintendent, later holding the same position together with electrical engineering activities for Maguire Industries, Bridgeport Electronics Division.

Mr. Mozer is a registered professional engineer and in addition to his editorial duties, will handle technical inquiries and general shop problems as a service of *Metal Finishing* to the industry.

HANDY & HARMAN BUILDS PLANT

G. H. Niemeyer, president of Handy & Harman, New York City, has just announced that his company is building a new plant in Los Angeles, California to more completely serve the increased demand for gold and silver as well as refining service on the Pacific coast. The company established an office in Los Angeles in the Bendix Bldg. in 1943 to warehouse brazing products for war industries and to serve users of gold and silver in the Arts. This office will be moved to the new location at 3625 Medford Street, Los Angeles where the plant opens the latter part of this year.



J. C. Leonard

Announcement is made by Oakite Products, Inc., New York, of the appointment of J. C. Leonard as sales manager of its Industrial Marketing Division. Associated with the Oakite organization in the servicing of its specialized cleaning materials and equipment for over 22 years, the last 16 years of which was in the capacity of manager of the company's Chicago Division, Mr. Leonard assumed his new duties on September 1, 1946. He will direct the marketing and servicing activities of the industrial field staff from the general offices of the company in New York.

Manufacturers' Literature

Publications listed in this department are obtainable from the manufacturer without charge.

Fluorine Manual

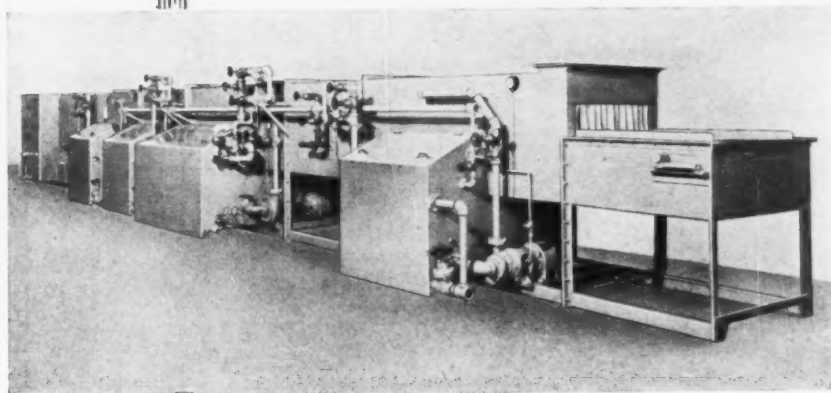
To supply available information on properties and precautions for handling fluorine to purchasers of this rare and highly reactive element, the *Pennsylvania Salt Manufacturing Co.*, Dept MF, Philadelphia, Pa., has prepared a preliminary manual, designated *Pennsalt Manual F-1*.

Because general commercial shipments of fluorine are such a recent development, potential users can secure all present information to bring their data up to date before beginning research with the gas. In June the company announced it was offering fluorine generally for research purposes for the first time.

Officials said since this is a preliminary manual to meet an immediate need, it will not be given the broad circulation now given to other basic manuals, such as the ones on Caustic Soda and Chlorine. In addition to going to research laboratories selected for first deliveries, the manual will be distributed to a small list of industrial firms and uni-

Over
20 Years
Devoted
Exclusively
To
Cleaning
Problems

Metalwash Model FT Bonderizing Unit



- For the handling of small parts on mesh conveyor.
- This machine, like all Metalwash units, furnished complete ready for services.
- No extras for valves, piping, etc.
- Standard or special designs of any type for any process.

Metalwash Machinery Co.

149-155 Shaw Avenue
Irvington 11, New Jersey

Washing, Pickling and Drying Equipment

versities and a few technical libraries.

The manual gives instructions for handling half pound cylinders of fluorine, including known data on first aid; the chemical and physical properties of the element, an outline of literature on organic fluorine compounds and an introduction to the chemical literature of inorganic fluorine compounds.

Since the toxicological properties of fluorine have not been fully investigated and present knowledge indicates that its action on the human body is similar to but more intense than anhydrous hydrofluoric acid, the recommended first aid treatment for the acid is given.

Rotating Electrical Equipment

Catalog No. 46-1, eight pages, two colors, describing rotating electrical equipment manufactured by *Electric Specialty Co.*,

Dept. MF, Stamford, Conn., manufacturers of special motors, generators, motor-generator units, converters, and other rotating electrical products. Illustrated in the catalog are numerous types of typical units which have been made by the company. Inasmuch as the company builds special equipment to specification and order, the catalog presents a general over-all picture of the scope of their manufacturing ability rather than specific models with definite standard specifications.

Included in general descriptions are A.C., D.C., and Universal motors for applications not met by standard motors; Dynamotors and Converters; Motor-Generator Sets; A.C. and D.C. Generators; Gas and Diesel Electric Generating Plants. General specifications cover the main construction points, uses, and the range of electrical and mechanical characteristics to which other units can be manufactured.

GRANODIZE



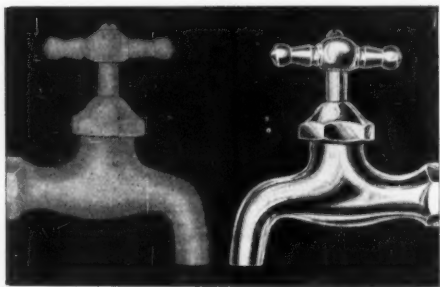
FOR SUPERLUSTER AND DURABILITY

Cold SPRAY-GRANODINE makes possible that beautiful, lustrous, pure white finish so much desired on modern refrigerators, kitchen cabinets and a host of other white finish metal products.

Cold SPRAY-GRANODINE the pioneer low temperature phosphate coating process (with peroxide), produces a uniform, dense, hard zinc phosphate coating that assures higher luster and paint durability needed to preserve a beautiful finish even under severe exposure conditions.

Cold SPRAY-GRANODINE, is ideally suited to processing (in continuous production in power spray washers) either large or small products, rapidly, efficiently and economically. The present trend toward Granodizing attests to its efficiency and time-proved effectiveness.

AMERICAN **ACF** CHEMICAL PAINT CO.
AMBLER PENNA.



New Improved LUSTREBRIGHT Bright Nickel Process

Produces Brilliant, Lustrous Nickel Deposits.
Eliminates Color Buffing—Re-Cleaning—Re-Racking.
An Ideal Base for Chromium. Excellent Throwing Power.
No Special Solutions or Changes in Equipment Required.
Easy to Control—Low in Cost—Successful—Practical.

Uniform results obtained on all classes of work in still tanks or mechanical barrels. Excellent for zinc die-castings. Any cold nickel solution of standard formula will with the addition of NEW IMPROVED LUSTREBRIGHT give brilliant, lustrous, adherent deposits. Guarantees

not to harm plating solution. Will not cause plate to peel, become brittle or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of NEW IMPROVED LUSTREBRIGHT. Write for complete information.

W. C. BRATE COMPANY
14 MARKET ST. Est. 1860 ALBANY, NEW YORK

Protected Type Motor

Bulletin No. 720, covering their Type OG Standard squirrel cage induction motor has just been released by The Louis Allis Co. The motor described is the protected type and is designed especially to give shielding against falling particles and dripping liquids.

Built expressly for use in heavy industrial atmospheres, the insulation is claimed to stand continuous load conditions of 115% without harm.

To obtain a copy of the bulletin write The Louis Allis Co., Dept. MF, Milwaukee 7, Wis.

Cleaning Handbook

The Phillips Chemical Co., manufacturers of production line cleaning compounds and industrial maintenance compounds, announces publication of their new handbook on "Production and Maintenance Cleaning." It gives information on proper methods and compounds for use in every type of production line cleaning as well as maintenance cleaning and is bound in a handy, pocket size booklet.

Included are recommendations for alkaline cleaners, electrolytic cleaners, emulsion cleaners, paint and enamel removers, rust removers, carbon removers, bright-dips, burn off and vapor solvent degreasing.

In addition, proper compounds and dilutions are recommended for every type of maintenance cleaning, such as hand soap, floor cleaner, steam cleaner, carbon remover, rust remover, drain cleaner and many others with special applications.

This handbook is offered free of charge on receipt of request on company letterhead to Phillips Chemical Co., Dept. MF, 3400 Touhy Ave., Chicago 45, Ill.

Sodium Hydride Descaling

An attractive brochure entitled "Holden Furnaces for Sodium Hydride Descaling" has recently been released by Holden. It is designed to give information about the technical phases of the sodium hydride process developed by Du Pont for descaling and suggests types of equipment for use with the process. The equipment and method is claimed to eliminate metal cleaning and descaling problems.

The brochure is amply illustrated with drawings, sketches, layouts and flow sheets. The applications, its features and advantages and the chemical basis of the process is explained. The maintenance, operation and cost characteristics are investigated, and a typical continuous production process with examples is given.

To obtain the brochure address an inquiry to The A. F. Holden Co., Dept. MF, New Haven 8, Conn.

Ion-Exchange Water Softener

Basic types of ion-exchange water softeners for industrial institutional and municipal use are explained in a booklet issued by The Permutit Co. Dept. MF, 330 West 42nd St., New York 18 N. Y.

The water softeners are of both pressure and gravity types which feature automatic equipment to control backwashing, brining

Du-Lite

SUCCEEDS WHERE OTHERS FAIL

Try Du-Lite's Black Chemifinish for uniform, trouble free finishing of steel parts. Du-Lite has justified its use after others have failed. Why? Because the efficiency and the easy workability of the Du-Lite Process, together with the toughness and the durability of its resultant finish, have been found most satisfactory again and again for all kinds of steel parts in regular production.

Our Field Engineer, located in your industrial area, will be glad to talk with you about your finishing problems. You can rely upon his advice and judgment. He is prepared to recommend needed processing equipment, supervise the installation, and train your men to operate it successfully.

Call or write Du-Lite at Middletown for service or further information.

DU-LITE
The Dependable
Black Chemifinish
for Steel Parts

DU-LITE CHEMICAL CORP.

DEPT. S, MIDDLETOWN, CONN.

Application of Backstands

"Production Talks Backstands" is the title of an attractive 12-page booklet published by the Behr-Manning Corp., Dept. S, Troy, N. Y., and exemplifies the trend toward conversion in metal finishing to hard grinding, finishing and polishing methods from the use of abrasive-coated set wheels, according to Behr-Manning.

The text covers seven case-studies from field engineers' reports on belt grinding and finishing with idler backstands; the illustrations represent illustrations of conversion results. All installations are claimed to have eliminated several operations, and resilient contact wheels used in conjunction with the backstand are said to have reduced the manual labor involved.

Case histories are of tool roughing and grinding; plow polishing under humidity conditions; cast-iron grinding; magnesium finish grind; cast aluminum rough grinding and pre-plating finish; and rough forge finishing.

The booklet may be had by directing an inquiry to the company.

Platers' Data Sheet

A technical data sheet for electroplaters being sent upon request to Industrial Linings Engineers, Inc., Dept. MF, Sewickley Office, Edgeworth, Pa. The sheet is presented in chart form; one section covers physical properties of tank linings and rack linings, while the other recommends linings and coverings for tanks and racks in various plating baths.

The firm does general job insulating of tanks and tanks with several different types of linings. A semi-hard thermoplastic coating is said to have especially good resistance to both acid and alkaline solutions, and has the added feature of being repairable with patching paste.

Plating Temperature Control

Designed to be of maximum usefulness to metal finishers is a new 16-page bulletin by Taylor Instrument Companies covering the application of automatic control instruments to electroplating and cleaning operations.

Of special interest is a tabulation of processes (in the case of cleaning) and metals (in the case of plating) properly related to solutions; recommended bath temperature limits; recommended thermal system materials and construction for various plating solutions; and control systems most adaptable to each process or metal.

Diagrammatic sketches are used liberally to illustrate instrument hookups for both heating and cooling of plating baths, for solvent degreaser temperature control, heating and cooling with bath circulation, and electric heating element control. Another section of the bulletin is given over to various types of thermometers and other accessories widely used on plating processes.

For a copy, write on company letterhead to the Taylor Instrument Companies, Dept. MF, Rochester, N. Y., for Bulletin 98165.

General Maintenance Cleaning

A new leaflet has been prepared by Wyandotte describing the specialized line of products for general maintenance cleaning mopping and scrubbing floors, washing painted surfaces and cleaning porcelain enamel. Advantages of using these products, Detergent, F-100, El-Bee Cleaner, 97 Paste and Steri-Chlor, as well as simple directions are included. Copies may be obtained by writing Wyandotte Chemicals Corp., Dept. MF, Wyandotte, Mich.

Rust Proofing Chemicals

Two new booklets recently released by ACP give data on that company's rust-proofing chemicals, protective coatings, metal cleaning chemicals, inhibitors, and their proprietary rust-proofing process for aluminum and its alloys.

A metal and process index is shown giving the recommended treatment for various

operations on different metals. Photos of installations of continuous type pickling and cleaning treatments are also shown as well as test panels of aluminum treated with and without use of their aluminum rust-proofing process. It is claimed that although this process is an immersion method, it produces by chemical means all-purpose, protective films comparable with anodic treatments.

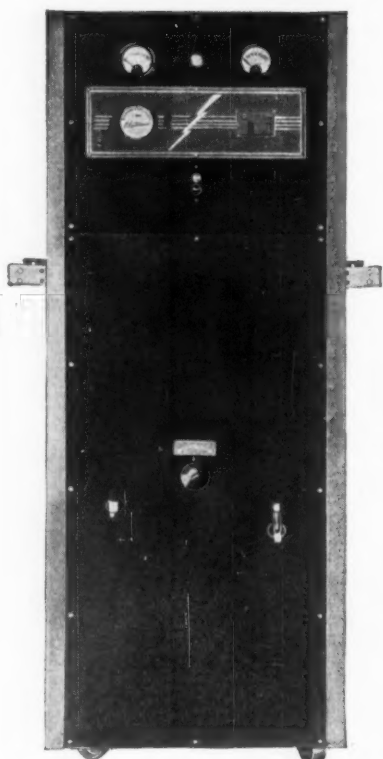
Copies of these booklets may be had by writing to the American Chemical Paint Co., Dept. MF, Ambler, Pa.

Protective Coating Comparison Chart

A comprehensive 8-page technical bulletin, in chart form, gives complete factual information about the entire Amercoat line.

Members of the bottling and dairy, brewing, chemical, food, marine, paper, petroleum, photographic, plating, public works, sewage and water works, textile and synthetic fibre manufacturing, transportation, wine and dis-

PRECISION - CONTROLLED electroplating with all R-A SELENIUM RECTIFIERS!



Here is the completely self-contained Rectifier with meters, off-on switch and stepless variable control.

Standard units are designed for 6 volts and 9 volts with current capacity of 500, 1000, 1500 and 2000 amperes.

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The chart shows all characteristics properties of Amercoat plastic coatings. it is a ready guide for selecting the coating, preparation of the surface, and application methods on steel, concrete, wood. In addition, cost per square foot materials, with area formulae, is provided.

A copy of this useful chart will be free on request. Write Amercoat Division, American Pipe & Construction Co., Box 3428, Terminal Annex, Los Angeles, Calif.

Selenium Rectifiers

A new folder explaining their selenium rectifiers has just been released by the Richardson-Allen Corp., Dept. MF, 15 W. St., New York 11, N. Y.

Explanation of selenium rectifiers various electrochemical applications is given together with a chart showing comparison of equipment for converting AC to DC current. Features and applications are listed, and installation techniques shown.

For copies and other pertinent information write to the company as above.

New Bulletins Issued

Six new leaflets for insertion in the previously distributed hard cover loose-leaf indexed catalog have just been released by the Belke Manufacturing Co., Dept. 947 N. Cicero Ave., Chicago 51, Ill.

The insertions cover Rubber Lining Covering; Automatic Transfer Machine Polishing and Buffing Lathes; Mechanical Plating Barrels; Plating Room Coating and Electrical Timers. Specifications, prices and applications are given together with explanatory material concerning each item.

The catalog is available to metal finishers by writing the company.

Special Time Switches

The purpose of a new bulletin, (No. T-5) is to treat with typical examples of low-voltage time switches as supplied by the Automatic Temperature Control Co., Inc. Many examples are cited, and it is claimed.

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Copies of the new bulletin may be obtained from the Automatic Temperature Control Co., Inc., Dept MF, 34 E. Logan St., Philadelphia 44, Pa.

Associations and Societies

AMERICAN SOCIETY FOR METALS NATIONAL METAL CONGRESS AND EXPOSITION LECTURES

Eighteen educational lectures dealing with four important and timely metallurgical subjects will feature the technical program of the American Society for Metals during the National Metal Congress and Exposition at Atlantic City, N. J., November 18th through 22nd.

W. H. Eisenman, secretary of ASM, pointed out that in addition to this series of lectures, more than seventy technical papers will be delivered during the five days of National Metal Congress—ASM meetings.

Five lectures each will be devoted to Electronic Methods of Inspection of Metals, Physical Metallurgy of Aluminum and Sleeve Bearing Metals. The Structure of Cast Iron subject will be covered in three lectures.

The "Electronic Methods of Inspection of Metals" lectures will be given during the afternoon periods Monday through Friday of the Congress week. Authors in this lecture series include Harry Hamburg, Chance Vought Aircraft, Stratford, Conn.; J. L. Sanderson, Dow Chemical Co., Midland, Mich.; R. S. Segsworth, General Engineering Co., Toronto, Canada; Charles Lickey and Harold T. Clark, Jones and Laughlin Steel Corp., Pittsburgh, Pa.; C. S. Barrett, Carnegie Institute of Technology, Pittsburgh, Pa.; E. O. Dixon, Ladish Drop Forge Co., Milwaukee, Wis., and Mrs. G. H. Tyne, Allied Control Co., New York, N. Y.

"Physical Metallurgy of Aluminum" lectures will be presented on Monday, Tuesday and Wednesday evenings and during the Thursday and Friday afternoon sessions. Its authors include W. L. Fink, F. Keller, W. E. Sicha, J. A. Nock and E. H. Dix, Jr., all of the Aluminum Company of America, New Kensington, Pa.

The five lectures on "Sleeve Bearing Metals" will be presented during the afternoon sessions on each of the five days. Six authors have prepared lectures on this subject. They are R. W. Dayton, Battelle Memorial Institute, Columbus, O.; F. R. Hensel, P. R. Mallory Co., Indianapolis, Ind.; Edwin Crankshaw, Cleveland Graphite Bronze Co., Cleveland, O.; A. F. Under-

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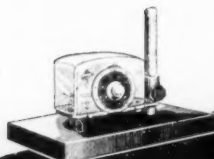
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wood. General Motors Research Laboratories, Detroit, Mich.; J. Falsulich, Wright Aeronautical Corp., Paterson, N. J., and William Henry Tate, Glucor Metals Ltd., England.

Alfred Boyles of the U. S. Felt & Foundry Co., Burlington, N. J., is author of the three lectures on "The Structure of Cast Iron." This series will be presented on Monday, Tuesday and Wednesday at the evening sessions.

TOWER TO GIVE TALK

Walter S. Tower, president of the American Iron and Steel Institute will be the principal speaker at the annual banquet of the American Society for Metals in Atlantic City on Thursday, November 21st. The announcement was made by W. H. Eisenman, national secretary of the Society.

The banquet will climax the ASM 28th annual convention which is held as a part of the National Metal Congress and Exposition. November 18th is the opening day of the N.M.C.E.

Mr. Tower's subject has not been announced although it is assumed that it will be selected for its timeliness.

AMERICAN ELECTROPLATERS' SOCIETY

1947 CONVENTION CITY CHANGED

The annual convention of the AES is to be held in Detroit, Mich., with the Hotel Statler as headquarters, instead of in Montreal, Canada, as formerly announced. The convention is planned for the week of June 23rd.

Mr. H. E. Head, 5547 Fairview, Detroit 13, Mich., is the chairman of the exhibits committee.

LOS ANGELES BRANCH

The Los Angeles Branch of the American Electroplaters' Society initiated its fall series of meetings with a well-attended session at the Cabrillo Hotel on the night of September 9.

Eighty members and guests were present when President D. N. Eldred called the educational session to order at 7:30 p.m.

Librarian Gilbert Extale provided a well-balanced three-phase program for the educational session. The first item consisted of a discussion of *Modern Porcelain Enameling* by Karl Raife, superintendent of the refrigerator cabinet division of the Norris Stamping & Manufacturing Co. of Los Angeles. Glenn Fulton, superintendent of the company's porcelain enameling department, presided at a question and answer period which was held by Raife and Fulton at the close of the talk.

They pointed out that the standards of cleanliness of surfaces for porcelain enameling are very high and that the processing of metal for enameling therefore shares many problems and practices in common with the electroplating industry.

At the close of the oral program, a color film entitled *The Making of Frit* was shown through the courtesy of the O. Hummel Co.

Mr. Raile supplying the descriptive catalogue.

The third phase of the educational program was the reading of a technical paper on Indium As a Brightener in Silver Solutions which had been prepared by Walter Beeseley, foreman-plater of the Wallington Plating Works, Vancouver, B. C., Canada.

Since Beeseley was unable to attend the meeting his paper was read by Librarian Estale. Beeseley is a member of Los Angeles Branch. After having served in the Army, he returned to the plating industry with an unusual enthusiasm for research and development in that field. His paper described clearly and concisely his experiences with indium brightener in silver solutions and, as presented at the meeting, appeared to have the weight of practical production experience to back his claims. Although the paper was short, it was replete with formulae and operational instructions.

AES TWIN CITIES BRANCH WINS METAL FINISHING CUP



The exhibit winner of this year's cup at the national convention of the American Electroplaters' Society was the Twin Cities Branch, Twin Cities covers the Minneapolis-St. Paul area.

The cup is presented each year by Metal Finishing magazine for the best exhibit of electroplated ware. A new cup is given every year, thus the winner is able to retain it permanently. This year the cup was gold-plated with the winner's name engraved in the metal and mounted on a handsome plastic base.

ELECTROCHEMICAL SOCIETY TORONTO CONGRESS OCTOBER 16 TO 19

The 90th Congress of The Electrochemical Society is to be held in Toronto, Ontario, Canada, from October 16 to 19, 1946.

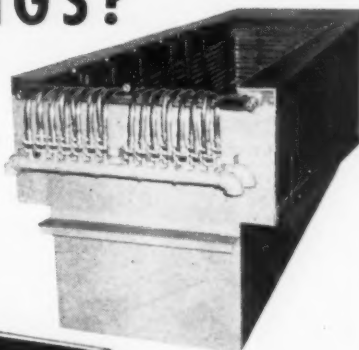
Papers of interest are to be presented each day and several trips are planned for Society members and their guests.

Headquarters of the Congress will be at the Royal York Hotel, Convention Foyer; registration will begin at 2:00 P.M., Wednesday, October 16, 1946.

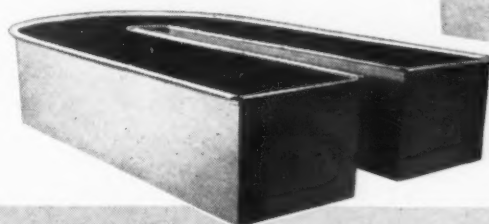
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Valuable Reference Books PLATING AND FINISHING

PRINCIPLES OF ELECTROPLATING AND ELECTROFORMING by Wm. Blum and G. B. Hogaboom. 2nd ed.; 1930; 424 pp. Price \$4.50. A practical explanation of the principles of electricity, general and analytical chemistry and electrochemistry essential to the electroplater. Processes, materials and plating formulas are given.

PLATING AND FINISHING GUIDEBOOK. 1946. Price \$1.00, payable in advance. A pocket handbook for the metal finisher. Contains tested formulas of all kinds for the practical man and gives methods for testing coatings and for analyzing plating solutions. Contains sections on organic finishing and on electrical equipment. 1946 is special spiral bound. Ready for distribution October 1st.

MODERN ELECTROPLATING. 1942; 400 pp. Price \$6.00 including service and postage. Prepared by various experts and supplied with many references. Provides a comprehensive survey of modern practice. The opening paper describes general principles and methods. Succeeding material deals with the various metal coatings and the solutions from which they are produced.

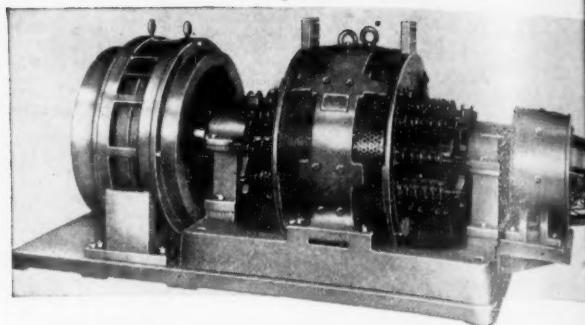
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